

Sydney Metro North West

Design and Construction of Surface
and Viaduct Civil Works



Construction Flora and Fauna Management Plan

NWRLSVC-ISJ-SVC-PM-PLN-120206

Revision 11.0

11 May 2017

Document Control

A controlled copy of the Construction Flora and Fauna Management Plan will be distributed to the Principal's Representative, Independent Certifier and other relevant stakeholders and will be available to all ISJV employees in soft copy format through the digital document control management system.

The Construction Flora and Fauna Management Plan if printed will be uncontrolled and it will be the responsibility of each user to confirm the currency of the plan through the digital document control management system.

Document distribution will be controlled in accordance with ISJV-SVC-PMS procedure MSP18 Document & Data Control.

Document Revision History

Doc No NWRLSVC-ISJ-SVC-PM-PLN-120206

Revision	Description	Prepared by	Reviewed by	Approved by	Date
4.0	Addresses consultation with Councils	Jane Murray Principal Ecologist (Biosis)	Steve Fermio pp Neville Hattingh	Graeme Tait	24-Jul-14
5.0	Addresses consultation with OEH	Jane Murray Principal Ecologist (Biosis)	Steve Fermio pp Neville Hattingh	Graeme Tait	29-Jul-14
6.0	Addresses consultation with OEH	Jane Murray Principal Ecologist (Biosis)	Steve Fermio pp Neville Hattingh	Graeme Tait	6-Aug-14
7.0	Addresses TfNSW comments, errors corrected in mitigation measures	R Pollard	T Austin	Marco Alpini	25-Mar-15
8.0	Addresses Audit Findings	R Pollard	T Austin	Marco Alpini	5 May 2015
9.0	General updates, remove references to Hornsby Council, update noxious weed list, revised nest box plan and ecological monitoring program	R Pollard/T. Austin	T Austin	Ian Stuart	18 Sept 2015
10.0	General update	J. Burgin	B. Tucker	G. Perdikaris	7 Dec 2016
11.0	Minor update to Appendix 6	J. Burgin	B. Tucker	G. Perdikaris	11 May 2017

Signature

Contents

Definitions and Abbreviations.....	4
1. INTRODUCTION	6
1.1 Purpose	6
1.2 Scope	6
1.3 Key Issues and Sensitive Areas.....	6
2. Relationship to Other Plans	8
3. Description of Sydney Metro Northwest Project.....	10
1.4 Description of NWRL Project	10
1.5 Description of the SVC Project works	10
4. CONDITIONS OF APPROVAL (COA) REQUIREMENTS	12
1.6 Major Civil Construction Works - North West Rail Link (SSI-5100)	12
1.7 Stations, Rail Infrastructure and Systems - North West Rail Link – SVC (SSI-5414).....	16
5. SUBMISSION REPORT REQUIREMENTS	18
1.8 Stage 1 Submissions Report (SSI-5100)	18
1.9 Stage 2 Submissions Report (SSI-5414)	20
6. DEED REQUIREMENTS	22
1.10 Deed Requirements	22
1.11 SWTC Requirements	22
1.12 CEMF Requirements.....	23
7. LICENCE AND PERMIT REQUIREMENTS.....	25
1.13 EPA Licence	25
8. MITIGATION MEASURES.....	26
9. MONITORING.....	40
10. INCIDENT PLANNING AND RESPONSE	42
11. TRAINING AND RESOURCES.....	45
12. REFERENCES AND REVISIONS	46
APPENDIX 1: Sensitive Area Maps.....	47
APPENDIX 2: Fauna Handling and Rescue Procedure.....	48
APPENDIX 3: Vegetation Pre-Clearing Procedure	57
APPENDIX 4: Weed Management Procedure	59
APPENDIX 5: Unexpected EEC/Threatened Species Procedure.....	65
APPENDIX 6: Ecological Monitoring Program	67
APPENDIX 7: Nest Box Plan.....	68
APPENDIX 8: Agency Consultation	69
APPENDIX 9: Green Star Rating	83
APPENDIX 10: Weed Mapping	84

Definitions and Abbreviations

Ambient Level	Existing level of a phenomenon without the influence of construction activities
ANZECC	Australian and New Zealand Environment Conservation Council
BoM	Bureau of Meteorology
CEMF	Construction Environmental Management Framework (Submissions Report, Section 3)
CEMP	Construction Environmental Management Plan
CFFMP	Construction Flora and Fauna Management Plan
CM	Construction Manager(s) (ISJV)
COA	Conditions of Approval
DPI	Department of Primary Industries
DP&E	Department of Planning and Environment
EC	Environment Coordinator
ECM	Environmental Control Map
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EM	Environment Manager (ISJV)
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act, 1999
Emission	A discharge of a substance (e.g. dust) into the environment
EMS	Environmental Management System
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ER	Independent Environmental Representative
ESCP	Erosion and Sediment Control Plan
GDE	Groundwater Dependent Ecosystem
IC	Independent Certifier
SI-BMS	Salini Impregilo– Business Management System
Incident	Any unplanned or undesired event which results in or has potential to result in injury, ill health, damage, to or loss of property, interruption to operations or environmental impairment. An incident also includes a near miss, breach of procedure, quality failure, injuries to employees, contractors or members of the public and any other statutorily reportable occurrence.
IND	Induction
ISJV	Impregilo S.P.A. (Australia) and Salini (Australia) Joint Venture / Principal Contractor
ISJVSVC PMS	ISJV SVC Project Management System
KPI	Key Performance Indicator
Mitigation Measures	Measures employed to reduce (mitigate) an impact
NOW	NSW Office of Water, Department of Primary Industries

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



OEH	Office of Environment and Heritage
PIRMP	Pollution Incident Response Management Procedure
PMP	Project Management Plan
PMS	Project Management System
POEO Act	Protection of the Environment Operations Act 1997
Pollution	The alteration of air, soil, or water as a result of human activities such that it is less suitable for any purpose for which it could be used in its natural state
REMM	Revised Environmental Mitigation Measures (Submissions Report, Section 7)
RMS	Roads and Maritime Service (formerly RTA)
SDS	Safety Data Sheets
SE	Site Engineer
SS	Site Supervisor
SSI	State Significant Infrastructure
SVC	Surface Viaducts and Civil Works for the North West Rail Link Project
SWQMP	Soil and Water Quality Management Plan
SWTC	Scope of Work and Technical Criteria
SMNW	Sydney Metro Northwest
TfNSW	Transport for New South Wales
TSC Act	Threatened Species Conservation Act, 1995
VMP	Vegetation Management Plan

1. INTRODUCTION

1.1 Purpose

The Construction Flora and Fauna Management Plan (CFFMP) provides a management strategy to effectively manage the Flora and Fauna within the limits of the Surface and Viaducts Civil Works (SVC) project. This CFFMP will ensure that the project quality is managed effectively across all the project quality activities & processes to consistently satisfy legislative, client and the ISJV Policies and management systems requirements.

The CFFMP describes how the ISJV will formally implement systematic flora and fauna management techniques, which will achieve the ISJV Policies, objectives and targets as well as the project objectives, targets and KPIs.

This plan is also consistent with the requirements of the following references:

- Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act).
- NSW Threatened Species Conservation Act, 1995 (TSC Act).
- NSW Fisheries Management Act, 1994.
- NSW Environment Planning and Assessment Act, 1979
- NSW National Parks and Wildlife Act, 1974
- NSW Noxious Weeds Act, 1993
- NSW Native Vegetation Act, 2003
- NSW Water Management Act 2000
- NSW Pesticides Act 1999

1.2 Scope

The CFFMP provides details of how flora and fauna will be managed by the ISJV in line with the Salini Impregilo's Business Management System, relevant Australian Standards, industry & manufacturer's guidelines, specifications and the Design and Construction of SVC Project Deed requirements.

This plan has been developed to describe how ISJV will meet its obligations to:

- Minimise impacts on flora and fauna.
- Design waterway modifications and crossings to incorporate best practice principles.
- Retain and enhance existing flora and fauna habitat wherever possible.
- Appropriately manage the spread of weeds and plant pathogens.
- Avoid negative impact to sensitive areas.

This CFFMP implementation will ensure that environmental process and activities are managed efficiently to consistently satisfy the Design and Construction of the SVC Deed requirements.

The CFFMP will be available to all the ISJV employees, suppliers, client including their representatives, Independent Certifier (IC) and other stakeholders. All employees and suppliers are required to comply with the Project Quality Plan as well as ISJV management system requirements and adhere to their nominated authorities and responsibilities.

1.3 Key Issues and Sensitive Areas

Key issues include the following potential risks:

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



- Disturbance or removal of flora and fauna habitat.
- Fragmentation and isolation of habitats.
- Damage or disturbance to vegetation communities, particularly endangered ecological communities (EECs).
- Damage or disturbance of protected or threatened flora species.
- Disturbance, injury or mortality of protected or threatened fauna species.
- Poor success at release of affected fauna.
- Disturbance impacts on retained native vegetation due to locating site compounds, workers, machinery or stockpiles.
- Damage or degradation of retained vegetation and fauna habitat as a result of land pollution
- Degradation of remnant vegetation by an increase in weed species.
- Inadequate disposal of removed weeds.
- Weeds/pathogens are inadequately controlled.
- Vegetation removal may result in a reduction in surrounding visual amenity.
- Vegetation removal and grubbing could increase risk of soil erosion.
- Increased sedimentation from site runoff from cleared areas.
- Inappropriate culvert and drainage works could adversely affect waterways.
- Inappropriate bridge construction including platform installation.
- Inappropriate waterway realignment.
- Restriction of fish passage through direct blockages during construction and operation of waterway crossings.
- Loss of feeding and breeding habitat for aquatic fauna.
- Potential hazardous chemical spillages leading to a reduction in water quality.
- Reduction in aquatic habitat quality through sedimentation and pollution of waterways.
- Aquatic weed growth, eutrophication or toxic algal blooms.

Sensitive area maps showing location of EECs and recorded threatened fauna species are contained in Appendix I. Eco Logical Australia (2012) identified two threatened vegetation communities within or adjacent to the construction footprint of the SVC. These are known as:

- Cumberland Plain Woodland in the Sydney Basin Bioregion TSC Act and Cumberland Plain Shale Woodlands EPBC Act (Cumberland Plain Woodland); Critically Endangered Ecological Community
- River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (River-flat Eucalypt Forest) – TSC Act; Critically Endangered Ecological Community.

Threatened flora and fauna Likelihood of Occurrence Tables (Eco Logical Australia 2012) indicate that no threatened flora is likely to occur within the project area; however, there is the potential for 23 species of threatened fauna to occur and mapped Green and Golden Bell Frog Habitat *Litoria aurea*, refer to Appendix 1. Migratory species have not been included (based on the EIS impact assessment determining that there would be negligible impact to any migratory species) and species are referred to by their common name for ease of reference. Pre-clearing surveys will ascertain if there are any changes.

2. Relationship to Other Plans

The position of the Construction Flora and Fauna Management Plan, to other plans within the ISJV Management System and overarching documentation framework is shown in Figure 1

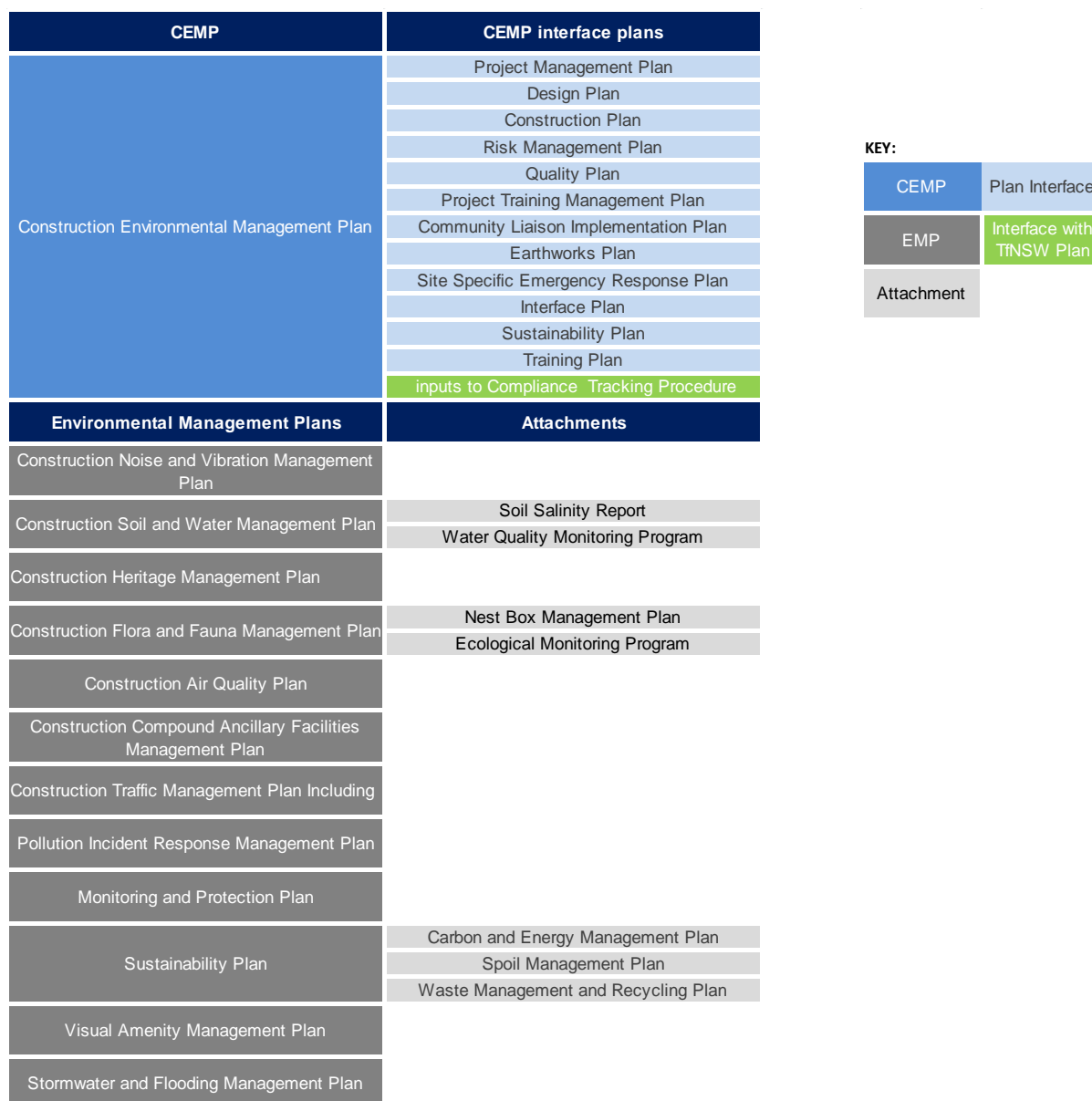


Figure 1- ISJV SVC-Management Systems and Document Framework

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



The Flora and Fauna Management Plan is part of the Construction Environmental Management Plan. The relationship of this plan to all other plans is indicated in Figure 2.

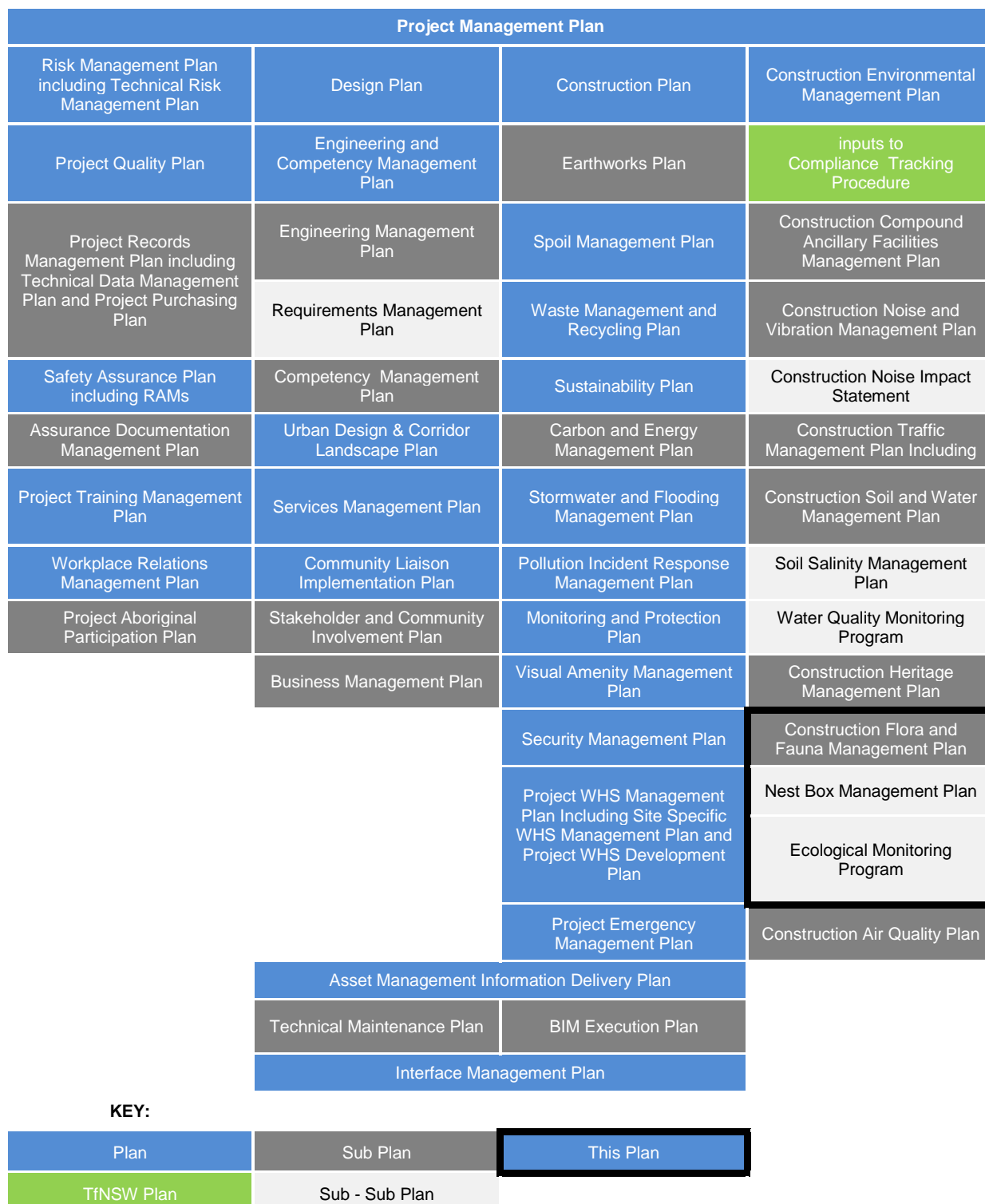


Figure 2- Hierarchy of SVC Management Plans

3. Description of Sydney Metro Northwest Project

1.4 Description of NWRL Project

The SMNW project is a key priority for the NSW Government. The SMNW will deliver a new high frequency single deck train system initially operating as a shuttle between Cudgegong Road and Chatswood. The project includes eight new stations, approximately 15.5km of tunnels from Epping to Bella Vista, a 4.5km elevated 'skytrain' (viaduct) between Bella Vista and Rouse Hill, and conversion of the Epping to Chatswood Rail Link to deliver high frequency rapid transit services.

Stations are planned at Cherrybrook, Castle Hill, Showground, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. Bus, pedestrian, cycling and easy access facilities will be provided at all stations, with approximately 4000 'Park and Ride' spaces spread across five sites.

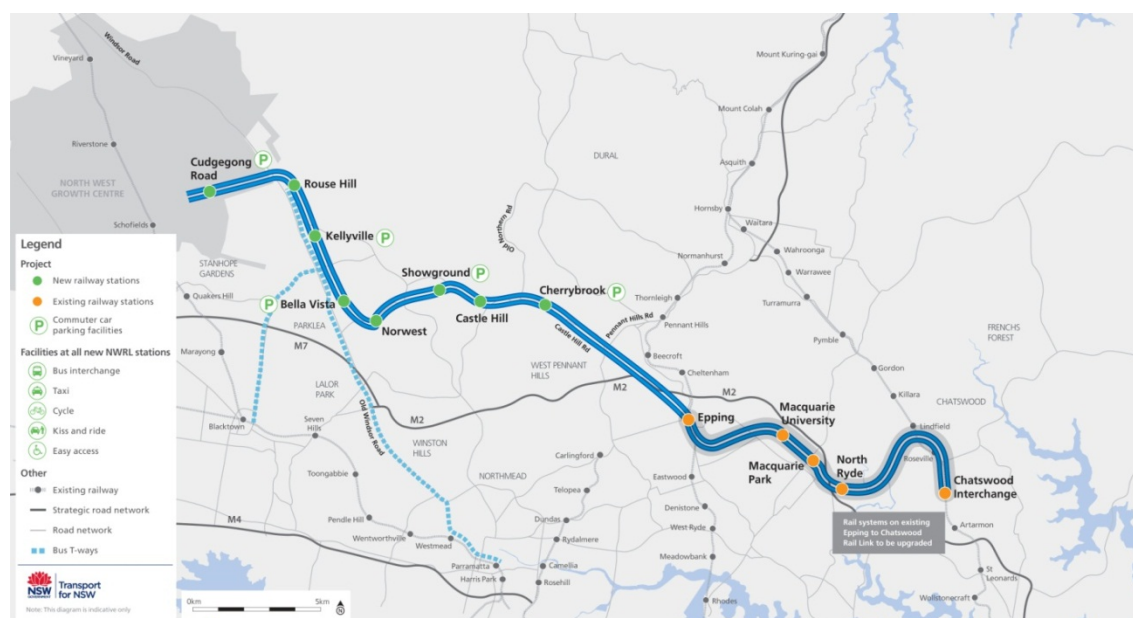


Figure 1: The North West Rail Link service proposed alignment

1.5 Description of the SVC Project works

The scope of the SVC Project works consists of the detailed design, construction and handover of the viaducts, bridges and associated civil works required for the SMNW between Bella Vista and Cudgegong Road and includes establishment and reinstatement of worksites, spoil removal and disposal and all required utility relocations and adjustments at construction worksites.

The permanent infrastructure to be delivered includes:

- Approximately 4.5 km of viaduct between Balmoral Road and Rouse Hill Station including crossings over Memorial Avenue, Samantha Riley Drive, Windsor Road, Sanctuary Drive and White Hart Drive
- Bulk earthworks requirements including all cut, fill and embankments between Balmoral Road and Cudgegong Road
- A bridge over Balmoral road

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



- Balmoral Road realignment
- A bridge over Windsor Road / Rouse Hill
- A bridge over Second Ponds Creek
- Allowance for station structures to be incorporated onto the viaduct at the Kellyville and Rouse Hill station sites
- Adjustments to existing infrastructure and roads within the construction site and / or otherwise affected by ISJV activities
- Safe, secure personnel access / egress into site areas including necessary temporary support services and site facilities, with hoardings, fencing and so on around worksites to be left in place upon completion
- Construction traffic and transport management including temporary and permanent traffic management works
- Removal of all temporary work and site facilities not otherwise required for handover to subsequent contractors.

Activities associated with the temporary and SVC Contractor works required in order to complete construction include:

- Construction of temporary T-way car parking at Rouse Hill and Kellyville
- Construction, removal and transportation of the gantry along the SVC construction zone
- Temporary changes to site personnel access/egress
- Signage, fencing and hoarding
- Construction environmental management activities
- Construction traffic management activities
- Interface and communications within SVC Contractor team and across Metro Northwest team
- Stakeholder liaison activities
- Adherence to Metro Northwest protocols and procedures.

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



4. CONDITIONS OF APPROVAL (COA) REQUIREMENTS

1.6 Major Civil Construction Works - North West Rail Link (SSI-5100)

No.	Ref.	Relevant Requirement	Area Addressed in CFFMP
1.	C1	<p>An Ecological Monitoring Program shall be developed to monitor the effectiveness of the biodiversity mitigation measures implemented as part of construction of the SSI. The Program shall be developed by a suitably qualified and experienced ecologist in consultation with OEH and relevant Councils and shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none">(a) an adaptive monitoring program to assess the effectiveness of the mitigation measures. The monitoring program shall nominate performance parameters and criteria against which effectiveness of the mitigation measures will be measured;(b) mechanisms for developing additional monitoring protocols to assess the effectiveness of any additional mitigation measures implemented to address additional impacts in the case of design amendments or unexpected threatened species finds during construction (where these additional impacts are generally consistent with the biodiversity impacts identified for the SSI);(c) provision for the assessment of the data to identify changes to habitat usage and whether this can be directly attributed to construction of the SSI;(d) details of contingency measures that would be implemented in the event of changes to habitat usage patterns directly attributable to the construction of the SSI; and(e) provision for annual reporting of monitoring results to the Director General, OEH and relevant Councils, or as otherwise agreed by those agencies. <p>Monitoring shall be undertaken during construction and until such time as the effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods, unless otherwise agreed by the Director General. The monitoring period may be reduced with the agreement of the Director General in consultation with OEH and relevant Councils depending on the outcomes of the monitoring.</p> <p>The Program shall be submitted to the Director General for approval no later than one month prior to the commencement of construction that would result in the disturbance of ecological communities, unless otherwise agreed by the Director General.</p>	Appendix 6, This Plan

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



No.	Ref.	Relevant Requirement	Area Addressed in CFFMP
2.	C2	Riparian Buffer Widths for waterways which are affected by the SSI are to be managed for a Total Riparian Buffer Width of between 10 m to 50 m where feasible and reasonable, dependant on the Category of Watercourse determined by the Riparian Assessment for the North West Rail Link (Eco Logical Australia 2011).	Section 8, This Plan, FF54
3.	C3	Watercourses affected by the proposal shall, where feasible and reasonable, be rehabilitated to emulate a natural stream system. The rehabilitation of watercourses shall be consistent with the <i>Guidelines for Controlled Activities</i> (DWE, 2008) and stream armouring should be minimised to the greatest extent practicable.	Section 8, FF52 and FF55 Vegetation Management Plan
4.	C4	Riparian vegetation in and around watercourses affected by the SSI shall be restored and rehabilitated (using endemic species, based on ecological communities River-flat Eucalypt Forest (riparian areas) and Cumberland Plain Woodland) in consultation with NSW Office of Water (NOW) and Department of Primary Industries (DPI) (Fisheries) and with the relevant Council/s. Restoration and rehabilitation measures, including timeframes and reporting on completion of works, shall be included in the Construction Flora and Fauna Management Plan (condition E46(f)).	Section 8, FF51 and FF53 Vegetation Management Plan
5.	C10	Watercourse crossings (temporary and permanent) shall be designed in consultation with NOW, and where feasible and reasonable, be consistent with the <i>Guidelines for Controlled Activities, Policy and Guidelines for Fish Friendly Waterway Crossings</i> (NSW Fisheries, 2004) and <i>Policy and Guidelines for Design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures</i> (NSW Fisheries, 1999). Where multiple cell culverts are proposed for creek crossings, at least one cell shall be provided for fish passage, with an invert or bed level that mimics creek flows.	Section 8, FF39, FF45 and FF56
6.	E3	The clearing of native vegetation will be minimised with the objective of reducing impacts to any threatened species or EECs to the greatest extent practicable. In particular, consideration of measures to reduce the impacts of clearing good condition vegetation at the Cheltenham Services Facility and associated access points will be undertaken.	Section 8, FF1 Note that the Cheltenham Services Facility is outside the SVC works area and is therefore not addressed within this Plan.
7.	E4	Where the clearing of bush land occurs within or in close proximity to areas currently subject to bush land restoration works, consultation shall be undertaken with the relevant council and other relevant stakeholders including bushcare groups regarding the management of current restoration works areas. The re-routing of walking tracks and associated signage will be implemented to reflect construction works within these bush regeneration and restoration areas.	Section 8, FF5
8.	E5	Prior to construction, pre-clearing surveys and inspections for threatened flora and fauna species and habitat features shall be undertaken. The surveys and inspections, and any subsequent relocation of species, shall be undertaken under the guidance of a qualified ecologist and the methodology incorporated into the Construction Flora and Fauna Management Plan (condition E46(f)).	Appendix 3, Pre-clearing survey (Biosis)

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



No.	Ref.	Relevant Requirement	Area Addressed in CFFMP
9.	E6	Prior to the commencement of construction work that would result in the disturbance of native vegetation (or as otherwise agreed by the Director General) a Nest Box Plan to provide replacement hollows for displaced fauna shall be prepared in consultation with the Office of Environment and Heritage (OEH) and relevant Council(s). The Nest Box Plan, to be incorporated into the Biodiversity Offset Package (condition C5), shall detail the number and type of nest boxes to be installed, which shall be justified based on the number and type of hollows removed (based on pre-clearing surveys), the density of hollows in the area to be cleared and in adjacent areas, and the availability of adjacent food resources. The Plan shall also consider the relocation of any hollows removed from the site to provide for potential nesting habitat. The Plan shall also provide details of maintenance protocols for the nest boxes installed including responsibilities, timing and duration.	Appendix 7, Nest Box Management Plan (Biosis)
10.	E46 (f)	A Construction Flora and Fauna Management Plan to detail how construction impacts on ecology will be minimised and managed. The Plan shall be developed in consultation with the OEH and relevant Councils (Hills Shire Council and Blacktown) and shall include, but not necessarily be limited to:	This Plan, Appendix 8
11.		i. plans for impacted and adjoining areas showing vegetation communities; important flora and fauna habitat areas; locations where threatened species, populations or ecological communities have been recorded; including pre-clearing surveys to confirm the location of threatened flora and fauna species and associated habitat features;	Appendix 1, Sensitive Site Maps
12.		ii. the identification of areas to be cleared and details of management measures (such as fencing, clearing procedures, removal and relocation of fauna during clearing, habitat tree management and construction worker education) to avoid any residual habitat damage or loss and to minimise or eliminate time lags between the removal and subsequent replacement of habitat;	Sections 8, 10 and Appendices.
13.		iii. vegetation management plan(s) for sites where vegetation is proposed to be retained and for reaches of riparian zones which intersect with the construction footprint;	Vegetation Management Plan
14.		iv. identification of measures to reduce disturbance to bats and nocturnal birds (and other sensitive fauna);	Section 8, FF36 This Plan
15.		v. rehabilitation details, including identification of flora species and sources, and measures for the management and maintenance of rehabilitated areas (including duration of the implementation of such measures);	Section 8, FF64, FF65, FF66, FF68 and FF69 Rehabilitation Site Plan
16.		vi. weed management measures focusing on early identification of invasive weeds and effective management controls;	Section 8, FF58, FF59 and FF60 Appendix 4, Weed Management Procedure

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



No.	Ref.	Relevant Requirement	Area Addressed in CFFMP
17.		vii. a description of how the effectiveness of these management measures would be monitored and linked to the Ecological Monitoring Program required under condition C1;	Section 9, This Plan
18.		viii. a procedure for dealing with unexpected EEC/ threatened species identified during construction, including cessation of work and notification of the Department, determination of appropriate mitigation measures in consultation with the OEH (including relevant re-location measures) and updating of ecological monitoring and/ or biodiversity offset requirements; and	Section 8, FF17, FF28 and FF37 Appendix 5, Unexpected EEC/threatened species Procedure
19.		ix. mechanisms for the monitoring, review and amendment of this plan.	Section 12, This Plan

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



1.7 Stations, Rail Infrastructure and Systems - North West Rail Link – SVC (SSI-5414)

No.	Ref.	Relevant Requirement	Area Addressed in CFFMP
20.	C23	The Ecological Monitoring Program required under condition C1 of State Significant Infrastructure Approval SSI-5100 shall continue and be updated as necessary during the construction of the SSI, unless otherwise agreed by the Director-General, in consultation with OEH and relevant Council's depending on the outcomes of monitoring.	Appendix 6 of This Plan
21.	C24	Riparian Buffer Widths for waterways which are affected by the SSI are to be managed for a Total Riparian Buffer Width of between 10m to 50m where feasible and reasonable, dependant on the Category of Watercourse determined by the Riparian Assessment for the North West Rail Link (Ecological Australia, 2011)	This Plan Section 8, FF5
22.	C25	Watercourses affected by the proposal shall be rehabilitated to emulate a natural stream system. The rehabilitation of watercourses shall be consistent with the Guidelines for Controlled Activities (DWE, 2008) and stream armouring should be minimised to the greatest extent practicable. Vegetation species for rehabilitation to reflect ecological community River-flat Eucalypt Forest.	Section 8, Vegetation Management Plan
23.	C26	Riparian vegetation in and around watercourses affected by the SSI shall be restored and rehabilitated in consultation with NOW and DPI (Fisheries) and with the relevant Council/s. Restoration and rehabilitation measures, including timeframes and reporting on completion of works, shall be included in the Construction Flora and Fauna Management Plan (condition E34(f)).	Section 8, Vegetation Management Plan
24.	C36	Watercourse crossings (temporary and permanent) shall be designed in consultation with NOW, and where feasible and reasonable, be consistent with the Guidelines for Controlled Activities, Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, 2004) and Policy and Guidelines for Design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures (NSW Fisheries, 1999). Where multiple cell culverts are proposed for creek crossings, at least one cell shall be provided for fish passage, with an invert or bed level that mimics creek flows.	Section 8, FF45
25.	E10	The SSI shall be constructed with the objective of not clearing additional vegetation beyond that approved under State Significant Infrastructure Approval SSI 5100 or identified in the documents listed in Condition B1.	This Plan
26.	E11	Where land associated with construction sites are not proposed to be utilised as part of the operational stage of the SSI, the Proponent shall ensure that these sites are fully rehabilitated to either the same level or better than their condition, prior to the construction of Infrastructure Approval SSI-5100, in consultation with relevant Council(s).	Vegetation Management Plan
27.	E34(f)	A Construction Flora and Fauna Management Plan to detail how construction impacts on ecology will be minimised and managed. The Plan shall be developed in consultation with the OEH and relevant Councils and shall include, but not necessarily be limited to:	This Plan, Appendix 8

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



No.	Ref.	Relevant Requirement	Area Addressed in CFFMP
28.		i. plans for impacted and adjoining areas showing vegetation communities; important flora and fauna habitat areas; locations where threatened species, populations or ecological communities have been recorded; including pre-clearing surveys to confirm the location of threatened flora and fauna species and associated habitat features;	Appendix 1, Sensitive Site Maps
29.		ii. the identification of areas to be cleared and details of management measures (such as fencing, clearing procedures, removal and relocation of fauna during clearing, habitat tree management and construction worker education) to avoid any residual habitat damage or loss and to minimise or eliminate time lags between the removal and subsequent replacement of habitat;	Section 8, This Plan
30.		iii. vegetation management plan(s) for sites where vegetation is proposed to be retained and for reaches of riparian zones which intersect with the construction footprint;	Section 8, FF1 and FF42 Vegetation Management Plan
31.		iv. identification of measures to reduce disturbance to bats and nocturnal birds (and other sensitive fauna);	Section 8, FF36 This Plan
32.		v. rehabilitation details, including identification of flora species and sources, and measures for the management and maintenance of rehabilitated areas (including duration of the implementation of such measures);	Vegetation Management Plan
33.		vi. weed management measures focusing on early identification of invasive weeds and effective management controls;	Section 8, FF58, FF59 and FF60 Appendix 4, Weed Management Procedure
34.		vii. a description of how the effectiveness of these management measures would be monitored and linked to the Ecological Monitoring Program required under condition C1;	Section 9, This Plan
35.		viii. a procedure for dealing with unexpected EEC/ threatened species identified during construction, including cessation of work and notification of the Department, determination of appropriate mitigation measures in consultation with the OEH (including relevant re-location measures) and updating of ecological monitoring and/ or biodiversity offset requirements; and	Section 8, FF17 and FF37 Appendix 5, Unexpected EEC/threatened species Procedure
36.		ix. mechanisms for the monitoring, review and amendment of this plan.	Section 12, This Plan

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



5. SUBMISSION REPORT REQUIREMENTS

1.8 Stage 1 Submissions Report (SSI-5100)

No.	Original Ref.	Relevant Requirement	Area Addressed in CFFMP
37.	E1	The ecological component of the site induction would include information on: <ul style="list-style-type: none">· Sensitivity of surrounding vegetation (particularly threatened vegetation).· Sensitivity of threatened fauna species (birds and bats).· Site environmental procedures (vegetation management, sediment and erosion control, protective fencing, weed control).· Emergency and incident response/ spill management (chemical spills, fire, injured fauna).	Section 8 & 11 off This Plan
38.	E2	Pre-clearing surveys would be undertaken to identify the presence of: <ul style="list-style-type: none">· Threatened flora and fauna	Appendix 6, Ecological Monitoring Program
39.	E4	The limits of clearing (e.g. edge of construction site footprint) would be clearly marked and minimised where feasible and reasonable.	Section 8, FF4
40.	E5	Where native vegetation is to be retained adjacent to or within construction sites, protective fencing and signage would be installed in accordance with Australian Standard 4970 – 2009 <i>Protection of Tree</i> .	Section 8, FF2
41.	E6	Trees containing hollows would be felled using “slow drop” technique, or similar, as agreed with the Department of Planning and Infrastructure (DP&I). The slow drop technique involves nudging and shaking the tree, followed by a controlled lowering of the tree to the ground.	Section 8, FF11
42.	E7	Where feasible and reasonable, topsoil and habitat elements (e.g. logs and felled trees) from sites that have few weed species would be stored and reused onsite.	Section 8, FF12
43.	E8	Site offices, stockpiles, machinery wash down areas, and plant storage areas would be located outside of any ecologically sensitive areas being retained onsite.	Section 8, FF7, Appendix 1
44.	E9	Fuel (or other chemical) storage would be located outside all riparian zones, and at least 10m from any retained ecologically sensitive areas onsite.	Section 8, FF38
45.	E10	Construction sites would be revegetated using endemic native plant species to comprise; River-flat Eucalypt Forest (riparian areas) and Cumberland Plain Woodland ecological communities.	Rehabilitation Site Plan

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



No.	Original Ref.	Relevant Requirement	Area Addressed in CFFMP
46.	E12	<p>To prevent establishment or spread of weeds:</p> <ul style="list-style-type: none"> · Machinery would be cleaned before entering work sites · Weeds would be removed from within the mapped native vegetation areas at least 10m from the edge of the construction footprint (where access allows). · Cleared weed material would be disposed of at a site licensed to receive green waste. 	Section 8, FF57
47.	E15	<p>To reduce disturbance to bats and nocturnal birds where reasonable and feasible, a range of measures would be undertaken, such as:</p> <p>Artificial lighting would be directed to where it is needed and in a downwards orientation to avoid light spillage, Artificial light would be positioned to face away from areas of native vegetation.</p> <p>Low-pressure sodium lamps would be used instead of high-pressure sodium or mercury lights. Where mercury lights are used, UV filters would be fitted.</p> <p>The brightness of lights would be reduced to as low as legally possible, and in conformance with workplace health and safety standards.</p> <p>Amplified speakers would be directed downwards and away from areas of native vegetation</p>	Section 8, FF36
48.	E16	Biodiversity offsets would be carried out consistent with the <i>Offset Strategy</i> and any conditions of approval.	TfNSW
49.	E17	Design of waterway crossings and structures would be undertaken in accordance with relevant guidelines such as <i>Fish and Fauna Friendly Waterway Crossings</i> (Fairfull & Witheridge, 2003) and <i>Fish Passage Requirements of Waterway Crossings</i> (2003). Relevant Government Agencies would be consulted with regard to crossings and waterway structures.	Section 8, FF39
50.	E18	Any creeks, core riparian zones and vegetated buffers disturbed by the project would be revegetated with the aim of maximising their ecological value.	Section 8, FF41
51.	E19	If feasible and reasonable, the proposed viaduct and bridge structural elements would be placed out of the creek(s) and away from the banks.	Section 8, FF43
52.	E20	The areas identified as 'likely' or 'potential' Groundwater Dependent Ecosystems (GDEs) would be considered in the development of the groundwater monitoring plan. Any groundwater monitoring undertaken within these areas would include monitoring of water quality and levels.	Section 8 , FF44
53.	E21	The potential spread of pathogens such as Phytophthora and Myrtle Rust would be addressed with appropriate mitigation during detailed construction planning.	Section 8, FF62

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



1.9 Stage 2 Submissions Report (SSI-5414)

No.	Original Ref.	Relevant Requirement	Reference
54.	E1	The ecological component of the site induction would include information on: <ul style="list-style-type: none"> • Sensitivity of surrounding vegetation (particularly threatened vegetation). • Sensitivity of threatened fauna species (birds and bats). • Site environmental procedures (vegetation management, sediment and erosion control, protective fencing, weed control). • Emergency and incident response/ spill management (chemical spills, fire, injured fauna). 	Section 8 & 11 This Plan
55.	E2	Pre-clearing surveys would be undertaken to identify the presence of: <ul style="list-style-type: none"> • Hollow bearing trees and other habitat features • Threatened flora and fauna 	Appendix 6, Ecological Monitoring Plan
56.	E6	Trees containing hollows would be felled using “Slow drop” technique (or similar as agreed with OEH). The slow-drop technique involves nudging and shaking the tree, followed by a controlled lowering of the tree to the ground.	Section 8, FF11
57.	E7	Where feasible and reasonable, topsoil and habitat elements (e.g. logs and felled trees) from sites that have few weed species would be stored and reused onsite.	Section 8, FF12
58.	E8	Site offices, stockpiles, machinery wash down areas, and plant storage areas would be located outside of any ecologically sensitive areas being retained onsite.	Section 8, FF7
59.	E9	Fuel (or other chemical) storage would be located outside all riparian zones, and at least 10m from any retained ecologically sensitive areas onsite.	Section 8, FF38
60.	E10	Construction sites would be revegetated using endemic native plant species where appropriate.	Section 8, FF70
61.	E12	To prevent establishment or spread of weeds: <ul style="list-style-type: none"> • Machinery would be cleaned before entering work sites. • Weeds would be removed from within the mapped native vegetation areas at least 10m from the edge of the construction footprint (where access allows). • Cleared weed material would be disposed of at a site licensed to receive green waste. 	Section 8, FF57

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



No.	Original Ref.	Relevant Requirement	Reference
62.	E15	<p>To reduce disturbance to bats and nocturnal birds where reasonable and feasible, a range of measures would be undertaken, such as:</p> <ul style="list-style-type: none">• Artificial lighting would be directed to where it is needed and in a downwards orientation to avoid light spillage, Artificial light would be positioned to face away from areas of native vegetation.• Low-pressure sodium lamps would be used instead of high-pressure sodium or mercury lights. Where mercury lights are used, UV filters would be fitted.• The brightness of lights would be reduced to as low as legally possible, and in conformance with workplace health and safety standards.• Amplified speakers would be directed downwards and away from areas of native vegetation.	Section 8, FF36
63.	E21	<p>Maintenance of waterway crossings and structures would be undertaken in accordance with relevant guidelines such as <i>Fish and Fauna Friendly Waterway Crossings</i> (Fairfull & Witheridge, 2003) and <i>Fish Passage Requirements of Waterway Crossings</i> (2003).</p>	Section 8, FF39
64.	E22	<p>Where native vegetation is to be retained adjacent to or within construction sites, protective fencing and signage (installed as part of EIS1) would be maintained in accordance with Australian Standard 4970 – 2009 <i>Protection of Trees</i>.</p>	Section 8, FF2

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



6. DEED REQUIREMENTS

1.10 Deed Requirements

No.	Original Ref.	Relevant Requirement	Reference
65.		N/A	

1.11 SWTC Requirements

No.	Original Ref.	Relevant Requirement	Reference
66.	7.13 (a)	Without limiting the requirements of the deed, the SVC Contractor must comply with the requirements in the Environmental Documents and ensure that significant trees (based on species, age or size) which may be affected by the SVC Contractor's Activities are identified and appropriate protection management measures implemented including fencing and pruning.	This Plan
67.	App 24.4, (g) (vi)	The Construction Environmental Management Plan must include, as sub-plans, the following plans that are required by the Project Planning Approvals: <ul style="list-style-type: none">Construction Flora and Fauna Management Plan	This Plan.
68.	App 24.4, (j)	In addition to the requirements identified in the Project Planning Approvals, the Construction Flora and Fauna Management Plan must include an estimate of the change in ecological value associated with the SVC Contractor's Activities (as calculated using the Green Building Council of Australia's Change in Ecological Value Calculator).	Sustainability Plan

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



1.12 CEMF Requirements

No.	Original Ref.	Relevant Requirement	Reference
69.	11.1 (a)	The following flora and fauna management objectives will apply to the construction of the project: i. Minimise impacts on flora and fauna. ii. Design waterway modifications and crossings to incorporate best practice principles. iii. Retain and enhance existing flora and fauna habitat wherever possible. iv. Appropriately manage the spread of weeds and plant pathogens.	Section 1, This Plan
70.	11.2 (a)	SMNW Principal Contractors will develop and implement a Flora and Fauna Management Plan which will include as a minimum:	This Plan
71.		i. The ecological mitigation measures as detailed in the environmental approval documentation.	Section 8, This Plan
72.		ii. The responsibilities of key project personnel with respect to the implementation of the plan.	CEMP
73.		iii. Procedures for the clearing of vegetation.	Appendix 3, This Plan
74.		iv. Ecological monitoring requirements.	Ecological Monitoring Plan
75.		v. Compliance record generation and management.	Section 12, This Plan
76.	11.2 (b)	Vegetation Management Plan(s) will be prepared for sites where vegetation is proposed to be retained and for reaches of riparian zones that intersect with the construction footprint.	Vegetation Management Plan
77.	11.2 (c)	SMNW Contractors would undertake the following ecological monitoring as a minimum: i. A pre-clearing inspection will be undertaken prior to any vegetation clearing by a suitable qualified ecologist and the Contractor's Environmental Manager (or delegate). The pre-clearing inspection will include, as a minimum: • Identification of hollow bearing trees or other habitat features. • Identification of any threatened flora and fauna. • A check on the physical demarcation of the limit of clearing. • An approved erosion and sediment control plan for the worksite. • The completion of any other pre-clearing requirements required by any project approvals, permits or licences.	Ecological Monitoring Program

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



No.	Original Ref.	Relevant Requirement	Reference
		<ul style="list-style-type: none"> The completion of the pre-clearing inspection will form a HOLD POINT requiring sign-off from the Contractor's Environmental Manager (or delegate) and a qualified ecologist. ii. The Principal Contractor's regular inspections will include a check on the ecological mitigation measures and project boundary fencing. 	
78.	11.2 (d)	<p>The following compliance records would be kept by the SMNW Principal Contractor:</p> <ul style="list-style-type: none"> i. Records of pre-clearing inspections undertaken. ii. Records of the release of the pre-clearing hold point. iii. Records of ecological inspections undertaken. 	Ecological Monitoring Program
79.	11.3	<p>Examples of flora and fauna mitigation measures include:</p> <ul style="list-style-type: none"> Areas to be retained and adjacent habitat areas will be fenced off prior to works to prevent damage or accidental over clearing. Clearing will follow a two-stage process as follows: <ul style="list-style-type: none"> - Non-habitat trees will be cleared first after sign-off of the pre-clearing inspection. - Habitat trees will be cleared no sooner than 48 hours after non-habitat trees have been cleared. A suitably qualified ecologist will be present on site during the clearing of habitat trees. Felled habitat trees will be left on the ground for 24 hours or inspected by the ecologist prior to further processing. Weed management is to be undertaken in areas affected by construction prior to any clearing works in accordance with the <i>Noxious Weeds Act 1993</i>. 	Section 8, This Plan

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



7. LICENCE AND PERMIT REQUIREMENTS

1.13 EPA Licence

No.	Original Ref.	Relevant Requirement	Reference
80.		Not Applicable to This Plan	

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



8. MITIGATION MEASURES

ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
Vegetation Protection and Management							
FF1	Native vegetation will be retained to the greatest extent practicable by utilising existing cleared areas and existing access tracks as much as possible, appropriately locating equipment on site and consideration of work methods to minimise ground disturbance required. This will also be in accordance with the Vegetation Management Plans.	■	■	Entire Project (Appendix 1)	SSI-5100, CoA, E3 SSI-5100, CoA, E46 (f) SSI-5414, CoA, E34(f)iii	SS / EC	Immediately prior to vegetation clearance and during construction
FF2	Where native vegetation is to be retained adjacent to or within construction sites, protective fencing and signage will be installed in accordance with Australian Standard 4970 – 2009 <i>Protection of Tree</i> . In addition to fencing area to be marked with: <ul style="list-style-type: none"> Flagging tape (red - individual trees to be retained, if possible, close to and/or adjoining the construction zone (yellow – habitat trees to be cleared) – verified by a member of the Environmental Team. Signage – indicates areas or trees to be protected, to be raised in the ISJV/SVC Induction (IND). A member of the environmental team will verify survey delineation of the subject site and parawebbing of the site Toolbox to be completed before the clearance of vegetation 	■		Entire Project	SSI-5100, REMM, E5	Ecologist	Immediately prior to vegetation clearance
FF3	Work methods will aim to limit soil disturbance as far as practicable by retaining vegetation adjacent to and between worksite specific worksites. Work areas will be fenced off on site to prevent unnecessary soil disturbance.	■	■	Entire Project	Best Practice	CM / SS	Pre-construction
FF4	The limits of clearing (i.e. edge and construction footprint) will be clearly marked on Environmental Control Maps (ECMs) and on site prior to clearing activities commencing.	■		Entire Project	SSI-5100, REMM, E4	EM / EC	Immediately prior to vegetation clearance

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
FF5	Where the clearing of bushland occurs within or in close proximity to areas currently subject to bush land restoration works, consultation shall be undertaken with the relevant council and other relevant stakeholders, including bushcare groups, regarding the management of current restoration works areas. The re-routing of walking tracks and associated signage shall be implemented to reflect construction works within these bush regeneration and restoration areas.	■	■	Where required	SSI-5100, CoA, E4	EM	Immediately prior to vegetation clearance, and as needed.
FF6	The extent of ecologically sensitive areas located adjacent to the works areas will be shown on relevant ECMs and physically delineated on site using protective fencing and signposting. Protective fencing and signposting will be maintained and replaced as required throughout construction. Signs indicating the area is a "SENSITIVE ENVIRONMENTAL AREA" will be clearly and securely affixed to the fencing. To be raised in IND. The Ecologically sensitive areas include: <ul style="list-style-type: none"> threatened species as per Eco Logical Australia 2012 Report, Critically Endangered Ecological Communities of Cumberland Plain Woodland, and River Flat Eucalypt Forest, and Riparian Areas. 	■	■	Where required	SSI-5100, REMM, E4	EM / CM	Immediately prior to vegetation clearance
FF7	Site offices, stockpiles, machinery wash down areas, and plant storage areas would be located outside of any ecologically sensitive areas being retained onsite.	■	■	Entire Site	SSI-5100, REMM, E8	SS	Construction
FF8	The clearing for compounds will be minimised by retaining mature trees and other vegetation of significance where feasible within the compound sites.	■	■	Entire Project	Best Practice	SS / EC	Pre-construction
FF9	Fuel (or other chemical) storage would be located at least 10 m from any retained ecologically sensitive areas onsite	■	■	Entire Project	SSI-5100, REMM, E9	SS	Construction
FF10	Prior to any clearing activities, a suitably qualified and experienced ecologist will conduct a pre-clearing survey in order to identify: <ul style="list-style-type: none"> hollow-bearing trees, other fauna habitat and any other significant flora or fauna features. (Record on Ecologist 	■		Entire Site	SSI-5100, REMM, E2	Ecologist	Immediately prior to vegetation clearance

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
	inspections records– and Appendix 2, Fauna), and update SAMs (Appendix 1) and Ecological Monitoring Program (Appendix 6).						
FF11	<p>Trees containing hollows would be felled using “slow drop” technique (or similar as agreed with DP&I). The slow drop technique involves nudging and shaking the tree followed by a controlled lowering of the tree to the ground.</p> <p>Clearing will be undertaken in a two staged process as follows:</p> <ul style="list-style-type: none"> • non-habitat trees will be felled first in order to give any fauna an opportunity to relocate from the area. • habitat trees will be felled after a minimum 24 hours delay after clearing of non-habitat trees. <p>Trees outside of the surveyed EIS /construction footprint will be recorded on Ecologist Inspections Records, if later removal is required. In addition, areas will be verified against the Sensitive Area Maps (Appendix 1) to determine presence or absence of threatened flora, fauna or ecological communities.</p>		■	Entire Site	SSI-5100, REMM, E6 SSI-5414, REMM, E6	SS / EC	During clearing
FF12	Habitat elements (e.g. logs and felled trees) from sites that have few weed species would be stored and reused onsite. This information will be recorded on Pre-Ground Disturbance Checklist		■	Entire Site	SSI-5100, REMM, E7	EC / SS	During clearing
FF13	<p>Initial clearing operations will be planned to collect leaf mulch, topsoil and other vegetation matter and to stockpile and maintain these materials for later reuse.</p> <p>Storage of topsoil needs to be carefully conducted and monitored to ensure no mixing with other sub-soil profiles. Need to remove, store and replace soil profiles in correct order if intention is to re-instate native vegetation.</p> <p>Cleared native vegetation will not be burned, but mulched and/or stockpiled for later use in erosion and sediment control or landscaping.to be included in ECM.</p>		■	Entire Project	Best Practice	SS	During clearing and rehabilitation works
FF14	The EC or delegate, at their discretion, would be on-site during vegetation clearing.		■	As required		EC / SS	As required

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
FF15	A suitably qualified and experienced ecologist will be present to supervise the felling of any hollow-bearing trees.		■	As required		Ecologist	As needed
FF16	Erosion and sediment controls will be installed prior to clearing activities, in order to protect bushland and watercourses outside the project area which may be impacted upon.	■	■	Entire Project	CEMF, 11.2 (c)	EC / SS	Prior to ground disturbance
FF17	If fauna species are found in areas to be cleared, immediately prior to clearing activities Fauna Handling and Rescue Procedure (see Appendix 2) will be implemented. Fauna will be relocated by a qualified ecologist to suitable habitat as close as possible to the area in which they were found. If animals are injured they would be taken to a veterinarian or suitable wildlife handler by a qualified ecologist/fauna handler.	■	■	Entire Project	SSI-5100, CoA, E46 (f) viii SSI-5414, CoA, E34 (f) viii	EC / Ecologist	Immediately prior to vegetation clearance
FF18	Trees that are cleared or pruned will be checked for habitat features prior to clearance and after felling or pruning. Habitat trees will be felled in accordance with the Vegetation Pre-clearing Procedure (see Appendix 3)	■	■	Entire Project		Ecologist / EM or delegate	Immediately prior to clearance/ during clearing
FF19	The engineer or sub-contractor engaged to remove or prune the trees will provide the project team with a schedule for the removal of each section of vegetation, including dates and times, to ensure that the work will be observed by the EC or their delegate.	■	■	Entire Project		EC	Prior to vegetation clearance
FF20	If unexpected threatened species are identified during construction or following pre-clearing surveys, works in the immediate vicinity will be ceased until an appropriate assessment of impacts and mitigation methods is completed, to be raised in the IND. (Refer Appendix 5 for Procedure). This will include consultation with Department of Primary Industries (DPI) and OEH. Management measures will include (as a minimum) relocation and the updating of the Ecological Monitoring Program and/or TfNSW implementing additional biodiversity offset requirements.	■	■	Entire Project		EM / CM	During Construction
Fire Management							

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
FF21	Mulch stockpiles will be smaller than one metre in height where practicable due to space constraints, regularly turned, and fuel loads from vegetation waste monitored. Vegetation close to site buildings or equipment will be pruned or removed to reduce fire risk.	■	■	Entire Project	Best Practice	SS	At all times during clearing and construction
FF22	No cleared vegetation will be burned.		■	Entire Project	SSI-5100, REMM, A3 SSI-5414, REMM, A3	SS	At all times
Terrestrial Native Flora and Fauna							
FF23	The EC (assisted by a qualified arborist or ecologist where deemed appropriate based on the significance of the vegetation, e.g. EEC, threatened species) will be present during excavation works within the vicinity of any significant trees that are not to be removed or relocated, to advise on any pruning required in accordance with Australian Standards		■	Where required		EC / Ecologist	When deemed appropriate
FF24	Protective fencing will remain in place until construction activities in that location are complete and all works in the area of vicinity cease to ensure that the risk of accidental clearing from construction activities is minimized, to be included in ECM.		■	Where required		SS	At all times until construction completed
FF25	If, during the course of construction (including vegetation clearing), the project personnel become aware of the presence of any threatened flora and fauna species that are likely to be significantly affected, the project will immediately cease those construction activities and relevant personnel will consult with OEH and/or DPI as appropriate. Following consultation, the Project will obtain any necessary licences required from OEH and not recommence work likely to affect the threatened species, until receiving advice from a qualified ecologist and/or OEH and/or I&I NSW.		■	Entire project		CM / EM	When unexpected threatened flora/fauna or EEC encountered
FF26	Any native fauna injured due to construction activities will be managed in accordance with Appendix 2 Fauna Handling and Rescue Procedure, to be raised in the IND and included in ECM..		■	As required		EC / SS	As required
FF27	<ul style="list-style-type: none"> All basins will allow egress of terrestrial fauna. All open trenches (>500 mm deep) will be surrounded with 		■	Entire project		SS	At all times

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
	<p>appropriate fencing prior to the conclusion of work for the day to avoid a fauna trap for amphibians, snakes etc.</p> <ul style="list-style-type: none"> No instances of terrestrial fauna inhabiting waste accumulation areas. No instances of terrestrial fauna congregation around artificial sources of light and offices. No fires, leaks or spills having an adverse effect on fauna populations and ecosystems. 						
FF28	Review of procedure for dealing with unexpected EEC/threatened species identified during construction (Appendix 5), including cessation of work and notification of OEH and DPI, determination of appropriate mitigation measures in consultation with the OEH (including relevant relocation measures) and updating of ecological monitoring and/or biodiversity offset requirements.	■	■	Entire project	SSI-5100, CoA, E46(f)viii	EC	As required
FF29	Stockpiling of soils and other materials will be restricted to cleared areas and will avoid native vegetation, to be included in ECM.			Construction zones	Best Practice	SS	At all times
Construction Lighting and Noise							
FF30	Construction compound lighting will be directed towards the ground. Glare will be kept to a minimum by keeping the main beam angle to less than 70° from the ground wherever possible.		■	Entire project	Best Practice	SS / EC	During construction
FF31	Non-translucent barriers will be positioned to shield sensitive areas located directly opposite night-works access points to minimise disturbance from vehicle headlights.		■	Entire project	Best Practice	SS / EC	During construction
FF32	Where feasible, site lighting will be directed away from sensitive areas such as potential foraging areas for nocturnal animals and movement corridors within the larger areas of intact bushland to include sensitive areas mapped in Appendix 1. Wherever possible, trees will not be directly illuminated.		■	Entire project	Best Practice	SS / EC	During construction
FF33	Accessories such as light shields mounted at the front or back of the light source will be utilised to direct light to the intended area only and minimise excessive light spill.		■	Entire project	Best Practice	SS / EC	During construction

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
FF34	Where feasible, the mounting height of the lighting column will be lowered to reduce horizontal light spill.		■	Entire project	Best Practice	SS / EC	During construction
FF35	The use of high power lamps used for security at compound sites should be avoided. Accessories such as glass protectors (preferred for their UV filtration characteristics) will be considered during the selection of light installation.		■	Entire project	Best Practice	SS / EC	During construction
FF36	<p>To reduce disturbance to bats and nocturnal birds where reasonable and feasible, a range of measures would be undertaken, such as:</p> <ul style="list-style-type: none"> Artificial lighting would be directed to where it is needed and in a downwards orientation to avoid light spillage. Artificial light would be positioned to face away from areas of native vegetation. Low-pressure sodium lamps would be used instead of high-pressure sodium or mercury lights. Where mercury lights are used, UV filters would be fitted. The brightness of lights would be reduced to as low as legally possible, and in conformance with workplace health and safety standards. Amplified speakers would be directed downwards and away from areas of native vegetation. 		■	Entire project	SSI-5100, REMM, E15	SS / EC	During construction
Aquatic Flora and Fauna							
FF37	<p>Works are to avoid sites mapped as potential habitat for threatened Green and Golden Bell Frog (Refer Appendix 1), unless the area has been surveyed by a suitably qualified ecologist to confirm GGBF is not present. This means all plant, equipment and foot traffic is to be excluded from these areas and no vegetation is to be removed. Sediment control measures are to be installed between the works and the habitat to prevent run-off settling in these habitats. Fencing and signposting will mark these sites as a no go zone and inductions will highlight their significance.</p> <p>If this species is detected, in an unexpected basin, works will not commence in the specific basin and consultation will occur with OEH</p>	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, E46(f)viii SSI-5414, CoA, E34(f)viii	CM / EM	During construction

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
	NSW. The Project will obtain any necessary permits or licences required in order to translocate threatened fauna species. Work will not commence until advice from a suitably qualified and experienced ecologist is received that all translocations have occurred. Refer Appendix 5 procedure for dealing with unexpected EEC/ threatened species identified during construction.						
FF38	Fuel (or other chemical) storage would be located outside all riparian zones to protect water quality and aquatic flora and fauna.		■	In the vicinity of aquatic habitats	SSI-5100, REMM, E9	SS / EC	During construction
FF39	Design and maintenance of waterway crossings and structures would be undertaken in accordance with <i>Policy and Guidelines for Fish Habitat Conservation and Management 2013</i> . Relevant Government Agencies would be consulted with regard to crossings and waterway structures.	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C10 SSI-5100, REMM, E17 SSI-5414, REMM, E21	EM / CM	Entire project
FF40	All works adjacent to or within waterways will be managed in accordance with the fish habitat classification of each waterway.		■	In the vicinity of aquatic habitats	Best Practice	EM / CM	During construction
FF41	Any creeks, core riparian zones and vegetated buffers disturbed by the project would be revegetated with the aim of maximising their ecological value.		■	In the vicinity of aquatic habitats	SSI-5100, REMM, E18	EM / CM	During construction
FF42	Vegetation Management Plans will be prepared for reaches of riparian zones which intersect with the construction footprint.	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, E46 (f)iii SSI-5414, CoA, E34(f)iii	EM / CM	During construction
FF43	The proposed viaduct and bridge structural elements would, as far as possible, be placed out of the creek(s) and away from the banks.	■	■	In the vicinity of aquatic habitats	SSI-5100, REMM, E19	EM / CM	During design and construction
FF44	The areas identified as 'likely' or 'potential' Groundwater Dependent Ecosystems (GDEs) would be considered in the development of the groundwater monitoring plan. Any groundwater monitoring undertaken within these areas would include monitoring of water quality and levels. (Refer Construction Soil and Water Management Plan for	■	■	In the vicinity of aquatic habitats	SSI-5100, REMM, E20	EM / CM	During design and construction

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
	Water Quality Monitoring Program).						
FF45	Watercourse crossing and culverts (either temporary or permanent) will be designed and constructed to be generally consistent with <i>Guidelines for Controlled Activities Watercourse Crossings (DWE, 2008)</i> ; and <i>Policy and Guidelines for Fish Habitat Conservation and Management 2013</i> . Category 2 watercourse crossings shall be bridged where reasonable and feasible; alternatively both category 2 and 3 watercourse culvert replacements shall incorporate a naturalised base.	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C10	EM / CM	During design and construction
FF46	Works around waterways will be managed to retain bank stability and prevent erosion.		■	In the vicinity of aquatic habitats	Best Practice	SS / EC	During construction
FF47	Water quality (and hence aquatic flora and fauna) will be protected through the implementation of suitable erosion and sediment control measures in all relevant work areas, in accordance with the Soil and Water Quality Management Plan (NWRLSVC-CSWMPV1R0-030314). NOW and relevant local councils will be consulted in developing these measures and these measures will be documented in the relevant CMSs and SHEWMS (Safety Health Environment Work Method Statement) as appropriate.	■	■	In the vicinity of aquatic habitats	CEMPF, 11.2(c)	EM / CM	During construction
FF48	During any in-stream and near stream works such as bridge pier column construction, water quality (and hence aquatic flora and fauna) will be protected under an ESCP (Erosion Sedimentation Control Plan). This may include suitably designed and maintained sediment and turbidity controls such as in-stream silt curtains, sediment fencing, runoff controls and geo-textile fabric sand bags. The protection measures will be designed to cope with a greater than average rainfall and/or flow event and will be regularly inspected and maintained through the construction and rehabilitation phase.	■	■	In the vicinity of aquatic habitats		EM / CM	During construction
FF49	Potential chemical pollutants will be stored in appropriate containers within bunded areas in construction compounds to minimise the risk of pollution of aquatic environments, to be raised in the IND .		■	Entire project	POEO Act, s120	CM / EM	During construction

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
FF50	Where practical, culverts will be aligned with the downstream channel to minimise bank erosion.	■	■	In the vicinity of aquatic habitats		EM / CM	During construction
FF51	Restoration and rehabilitation plans for riparian areas including timeframes and reporting on completion will be developed progressively throughout construction by the Environment Manager with input from the Construction Team, Soil Conservationist and qualified ecologists as required. These plans will be developed within 3 months of finalization of design at relevant locations in order for rehabilitation works to be undertaken as soon as possible following construction. Consultation during the development of Vegetation Management Plan will occur with NOW, I&I NSW and the relevant Council.	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C4	EM	During construction
FF52	<p>The rehabilitation of watercourses will be generally consistent with the Guidelines for Controlled Activities: In-stream Works (DWE 2008). This will include:</p> <ul style="list-style-type: none"> • protection against scour through the use of vegetation wherever possible. Stream armouring (rock rip-rap) will only be used where vegetation is not deemed suitable; • rehabilitation to emulate a natural stream system; and • monitoring and maintenance of rehabilitation works until suitably stabilised. <p>Specific rehabilitation measures for each watercourse will be documented in Vegetation Management Plan prepared in accordance with measure FF51 above.</p>	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C3	EM / CM	During construction
FF53	To maintain creek bank stability, Riparian vegetation disturbed by construction works will be replaced with endemic species (refer to Vegetation Management Plans). Where other methods of bank stabilisation are required to be used, this will be in consultation with the Soil Conservationist.	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C4	EM / CM	During construction
FF54	Riparian Buffer Widths for waterways which are affected by the SSI are to be managed for a Total Riparian Buffer Width of between 10 m to 50 m, dependent on the Category of Watercourse determined by	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C2	EM / CM	During construction

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
	the Riparian Assessment for the North West Rail Link (Ecological Australia 2011). Waterways within the area have been classified into stream order: Caddies Creek (3rd order stream) and Second Ponds Creek (2nd order stream) in accordance with Central Mapping Authority of New South Wales, 1983, Topographic Map 1:25 000 Second Edition – Riverstone 9030-I-S.						
FF55	Watercourses affected by the proposal will be rehabilitated to emulate a natural stream system. The rehabilitation of watercourses shall be consistent with the <i>Guidelines for Controlled Activities (DPI 2012)</i> and stream armouring should be minimised to the greatest extent practicable. Rehabilitation vegetation (species) to comprise River-flat Eucalypt Forest.	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C3	EM / CM	During construction
FF56	Watercourse crossings (temporary and permanent) will be designed in consultation with NOW, and be consistent with the <ul style="list-style-type: none"> <i>Policy and Guidelines for Fish Habitat Conservation and Management 2013.</i> <i>Guidelines for Controlled Activities, Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries 2004); and</i> <i>Policy and Guidelines for Design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures (NSW Fisheries 1999).</i> Where multiple cell culverts are proposed for creek crossings, at least one cell will be provided for fish passage, with an invert or bed level that mimics creek flows.	■	■	In the vicinity of aquatic habitats	SSI-5100, CoA, C10	EM / CM	Pre and during construction
Weed and Pathogen Management							
FF57	To prevent establishment or spread of weeds: <ul style="list-style-type: none"> Machinery will be cleaned before entering work sites. Weeds will be removed from within the mapped native vegetation areas at least 10 m from the edge of the construction footprint (where access allows). Removal of weeds within native vegetation areas to be 		■	Entire project	SSI-5100, REMM, E12	EM / CM	Ongoing

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
	<p>retained is to be conducted by qualified bush regenerators. To limit spread of weeds to other areas, weed removal within construction footprint may be undertaken by others as per agreed methodologies documented in Weed Management Procedure – Appendix 4.</p> <ul style="list-style-type: none"> Cleared weed material will be disposed of at a site licensed to receive green waste. This will be recorded in ISJVSVC-PMS MSR22W-1 Waste Register in accordance with ISJVSVC-PMS MSP22W Waste Management. IND Where pesticide is used to control weeds it will be in accordance with Appendix 4. 						
FF58	Noxious weeds and topsoil containing noxious weeds or weed seeds will be transported to a suitably licensed waste facility and recorded in ISJVSVC-PMS MSR22W-1 Waste Register in accordance with ISJVSVC-PMS MSP22W Waste Management. IND .		■	Entire project	SSI-5100, CoA, E46 (f) vi SSI-5414, CoA, E34(f)vi	CM / EM	Ongoing
FF59	Noxious weed mapping will occur progressively prior to clearing works in each location. Weed management will occur throughout the extent and duration of the project in accordance with ISJVSVC-PMS WI22T-6 Weed Control.		■	Entire project	SSI-5100, CoA, E46 (f) vi SSI-5414, CoA, E34(f)vi	CM / EM and Ecologist	Pre-clearing
FF60	Any relevant permits to destroy or remove noxious weeds under the <i>Noxious Weeds Act 1993</i> would be obtained prior to undertaking works.	■		Entire project	SSI-5100, CoA, E46 (f) vi SSI-5414, CoA, E34(f)vi	CM / EM	Pre-clearing
FF61	All earth moving machinery will be inspected upon arrival to site to ensure it is free from excessive soil and vegetative matter to minimise the likelihood of introducing weeds seeds and plant pathogens. The previous location of the machinery will be determined to ascertain if it has come directly from a high weed / pathogen source, to be included in the ECM.		■	Entire project	SSI-5100, REMM, E12 SSI-5414, REMM, E12	CM / SS	Pre-construction, and ongoing

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
FF62	The potential spread of pathogens such as Phytophthora and Myrtle Rust would be addressed with appropriate mitigation during detailed construction planning. Stumps and roots and any other below ground material will not be used in mulch to control the possible spread of <i>Phytophthora cinnamoni</i> (Root Rot Fungus), to be included in the ECM		■	Entire project	SSI-5100, REMM, E21	EM / CM	Pre-construction and during construction
FF63	Weeds to be controlled as required in areas affected by construction in a staged manner and for a minimum period of two years following construction works. Refer to Weed Management Procedure (Appendix 4) and Vegetation Management Plan .		■	Entire project		EM	As required during construction and ongoing for 2 years
Revegetation							
FF64	Seed will be collected within the corridor prior to and during clearing to be used as part of the Vegetation Management Plan. Suitable felled native trees will be used to enhance adjacent habitat.	■	■	Entire project	SSI-5100, CoA, E46(f)v SSI-5100, CoA, E34(f)v	EM / CM and Ecologist	Pre-clearing and during clearing
FF65	Felled native trees will be reused for habitat augmentation within revegetated areas. Other native vegetation cleared for construction will be mulched for later reuse in soil stabilisation and revegetation works.		■	Revegetation areas	SSI-5100, CoA, E46(f)v SSI-5100, CoA, E34(f)v	EM / CM	Pre and post-construction
FF66	Topsoil stripped during initial clearing activities will be stockpiled, covered and reused during revegetation works as soon as possible in order to utilise the soil seed bank.		■	Revegetation areas	SSI-5100, CoA, E46(f)v SSI-5100, CoA, E34(f)v	EM / CM	Pre and post-construction
FF67	A revegetation strategy will be developed that takes into account the availability of light, moisture and the most suitable plant species. Where practicable areas of disturbance not subject to permanent works will be revegetated at least to their pre-existing condition. Revegetation works will occur progressively.	■	■	Revegetation areas	Vegetation Management Plan	EM and specialists	Ongoing
FF68	Advice and input from appropriate and experienced specialists would	■		Revegetation	SSI-5100, CoA,	EM and	Pre-clearing

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



ISJV Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
	be sought in developing rehabilitation plans for affected watercourses.			areas	E46(f)v SSI-5100, CoA, E34(f)v	specialists	
FF69	Management measures to enhance native fauna habitat will include bush regeneration with appropriate species (refer to <i>Rehabilitation Site Plan</i>) installation of nest boxes for birds and bats (Appendix 7), and the use of boulders and felled timber to enhance the structural complexity of fauna habitat.	■	■	Entire project	SSI-5100, CoA, E46(f)v SSI-5100, CoA, E34(f)v	EM	Ongoing
FF70	Construction sites would be revegetated using endemic native plant species where appropriate. Refer Vegetation Management Plan	■	■	Entire project	SSI-5100, REMM, E10	EM / CM	Post-construction
Responsibility Key: EM – Environment Manager, CM – Construction Manager, SS – Site Supervisor, EC – Environment Coordinator							

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



9. MONITORING

Item	Frequency	Standards	Reporting	Responsibility
Site Inspections	Daily	Ensure management of such controls as onsite retained vegetation and clearing boundaries		SS
Inspect "No Go/Exclusion Zone" areas and preserved vegetation	Daily	Exclusion maintained.		SS
Site Inspections	Weekly	Maintenance of flora and fauna management controls	ISJVSVC-PMS MSF43-2 Environmental Inspection Checklist	EC
The following compliance records will be maintained: <ul style="list-style-type: none"> Records of pre-clearing inspections undertaken. Records of the release of the pre-clearing hold points. Records of inspections undertaken. Records of ecological monitoring. 	As required.	-	iTwoCx Hold Point Register ISJVSVC-PMS MSF43-2 Environmental Inspection Checklist Ecological Monitoring Program	EC / EM / Ecologist
As per Ecological Monitoring Program	-	-	-	Biosis
Weather forecasts	Daily	Dry/wet weather	To All ISJV staff	Project Administrator

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



Item	Frequency	Standards	Reporting	Responsibility
<p>An environmental inspection shall be undertaken during the vegetation clearance stages of each development phase, including:</p> <ul style="list-style-type: none"> • monitor extent of vegetative clearing. • monitor egress points, sediment basins, excavations, trenches and equipment for fauna and for repair. • inspect for fauna before and after excavation activities, and report all injuries and mortalities to EM. • ensure trenches are fenced if not in use for more than 24 hours. • monitor open trenches. • monitor fauna inhabiting waste receptacles, offices and lighting sources. • monitor vehicle and equipment movements on designated tracks. • monitor speed limit compliance to reduce dust generation. • inspect for adequate fire breaks around the work areas and for possible fire hazards. • monitor signage onsite ensuring vegetation boundaries are clearly identifiable. • monitor water or dust suppressant being applied to soil and aggregate stockpiles and tracks and roads. • inspect secondary containment of liquids, fuels and chemical. 	Daily	See CEMP Non-conformance issues and corrective action requests	ISJVSVC-PMS MSF43-2 Environmental Inspection Checklist	SS / EC
Monitoring and maintenance of watercourse rehabilitation works until suitably stabilised per Vegetation Management Plan	Monthly	Watercourse stabilised and vegetation established-	Monthly Report	Narla/TfNSW (as per C44 as it applies to SVC works).

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



10. INCIDENT PLANNING AND RESPONSE

Incident Planning & Response				
Potential incidents that could arise during the works include the following:				
No.	Situation	Response	Timing	Responsibility
1	Potential for Spill	Provide spill kits at bunded areas and all work sites. Ensure spill kits are kept stocked at all times.	Pre-construction / construction	CM
2	Potential for Spill	Train field staff in the contents and use of spill kits.	Pre-construction	CM
3	Spill occurrence	Report spills immediately to the Environmental Manager or Environmental Coordinators.	Immediately, as required	EC
4	Spill occurrence	Immediately report all spills that cause or are likely to cause environmental harm to EPA's Environment Line (131 555), and notify relevant agencies. Follow PIRMP (Pollution Incident Response Management Plan).	Within 24 hours, as required	EM
5	Spill occurrence	Implement the spill management procedure in the event of an oil or chemical spill. Procedure contained in PIRMP (Pollution Incident Response Management Plan).	As required	EC
6	An area inadvertently disturbed	Immediately stabilise any areas inadvertently disturbed and replant with ecologically compatible vegetation in accordance with Vegetation Management Plan.	Immediately, as required	SS / ESR/ Ecologist
7	Potential for fish kills	The EPA is the Appropriate Regulatory Authority and is to be notified immediately via EPA's Environment Line (131 555). Fisheries NSW should also be advised of any incidents via email to: wollstonecraft.fisheries@dpi.nsw.gov.au .	Immediately, as required	EM
8	Fauna encountered or injured during the works.	In accordance with Fauna Handling and Rescue Procedure (Appendix 2). A list of carers and veterinarians in order of proximity to the site will be included in this procedure.	As required	Ecologist

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



Incident Planning & Response				
Potential incidents that could arise during the works include the following:				
No.	Situation	Response	Timing	Responsibility
9	Emergency euthanasia – If an animal is severely injured and immediate contact with a wildlife rescue agency or veterinarian is not possible, and it is the opinion that the animal requires immediate euthanasia.	In accordance with Fauna Handling and Rescue Procedure (Appendix 2). The procedure will cover the following points: <ul style="list-style-type: none"> The animal will be humanely euthanized in the field by the wildlife permit holder following the methods approved in their animal ethics approval. All injuries or deaths are recorded and the information forwarded to the relevant Animal Ethics Committee and OEH. 	As required	Ecologist
10	Significant, rare, threatened or endangered flora or fauna species or communities are discovered during works.	In accordance with Unexpected EEC/threatened species Procedure (Appendix 5).	As required	Ecologist / SS
11	Unnecessary vegetation clearing and removal of hollow bearing trees which provide important habitat	In accordance with Vegetation Pre-clearing Procedure (Appendix 3).	Pre-construction	SS
12	Unauthorised vehicle and plant movements outside the corridor in adjoining vegetated areas	In accordance with Vegetation Pre-clearing Procedure (Appendix 3).	Pre-construction	SS
13	Inadvertent disturbance of EECs and other areas of habitat outside of the construction area	Protect/fence all areas in accordance with Vegetation Pre-clearing Procedure (Appendix 3) and Sensitive Site Maps (Appendix 1).	Pre-construction	SS

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



Incident Planning & Response				
Potential incidents that could arise during the works include the following:				
No.	Situation	Response	Timing	Responsibility
14	Inappropriate construction of temporary and permanent waterway crossings (riparian flora and removal of fauna corridors)	Protect/fence all areas in accordance with Vegetation Pre-clearing Procedure (Appendix 3) and Sensitive Site Maps (Appendix 1).	Pre-construction	SS
15	Inadequate erosion and sediment control.	In accordance with Sedimentation Control Plans.	Construction	SS
16	Temporary and permanent changes in hydrology and drainage regimes.	To be guided by DPI. Site supervisor to advise EM and EC if any likely changes (temporary or permanent) to hydrology and gain advice on how to proceed with DPI and potentially local Councils.	Construction	SS
17	Inappropriate waste disposal encouraging feral animals and pests to frequent the construction site.	Refer Waste Management and Recycling Plan	Construction	SS
18	Direct mortality and injuries by road strike and from construction machinery during the works.	In accordance with Fauna Handling and Rescue Procedure (Appendix 2). A list of carers and veterinarians in order of proximity to the site are included in this procedure.		SS
	Any incident should be reviewed and necessary plans, management actions updated accordingly.		Post incident	EM
	Responsibility Key: EM – Environment Manager, CM – Construction Manager, CSM – Community and Stakeholder Manager, EC – Environment Coordinator, SS- Site Supervisor			

11. TRAINING AND RESOURCES

Training

Inductions are required and are to address:

- Matters identified by the term “IND” (“Induction”) in the mitigation measures section.
- Induction attendance is recorded and maintained.

The ecological and flora and fauna component of the site induction would include information on:

- Sensitivity of surrounding vegetation
 - particularly EECs (Appendix 5); and
 - as shown on Environment Control Maps (ECM'S) to detail clearing boundaries, and environmental no-go areas (Appendix 1).
- Sensitivity of threatened fauna species (birds, frogs and bats).
- Sensitivity of aquatic flora and fauna (particularly fish).
- Site environmental procedures (vegetation management, protective fencing, weed control as per Appendices), and sediment and erosion control per Construction Soil and Water Management Plan.
- Emergency and incident response/ spill management (chemical spills, fire, injured fauna).

Site Inductions are recorded in the Projects' on-line system (Damstra), checked with *MSF15-7 Induction Assessment Form* and maintained in Damstra. The *MSF15-6 Site Induction Form* and *MSR15-3 Site Induction Register* have been superseded by Damstra even though a lot of the information requirements from these documents have been retained in Damstra.

Toolbox talks to be conducted for relevant personnel on:

- Type, location and measures for managing protected or threatened flora, fauna or EECs (Appendix 1 and Appendix 5).
- Fauna Handling and Rescue Procedure (Appendix 2).
- Vegetation Pre-clearing (Appendix 3), including machinery cleanliness, mulching and soil stockpiling.
- Weeds identification and management process (Appendix 4) including use of pesticides.
- Unexpected EEC/threatened species Procedure (Appendix 5).
- Nest Box Plan (Appendix 7).
- Rehabilitation Site Plan for retained vegetation and riparian zones.
- Works around waterways

Reinforce and reiterate information from inductions and where procedures are amended or new procedures are introduced.

Record Toolbox Talks using ISJVSVC-PMS MSF 15-5A Environmental Toolbox Records.

Resources

- Temporary erosion and sediment controls (eg. geotextile, etc).
- Bunded areas with spill kits.
- Environmental Manager, Environmental Coordinators.
- Ecologist – Biosis/Cumberland Ecology/Narla.
- Fencing and signage
- Herbicide operators/contractors if required.
- Procedures (Appendix 1-7).

12. REFERENCES AND REVISIONS

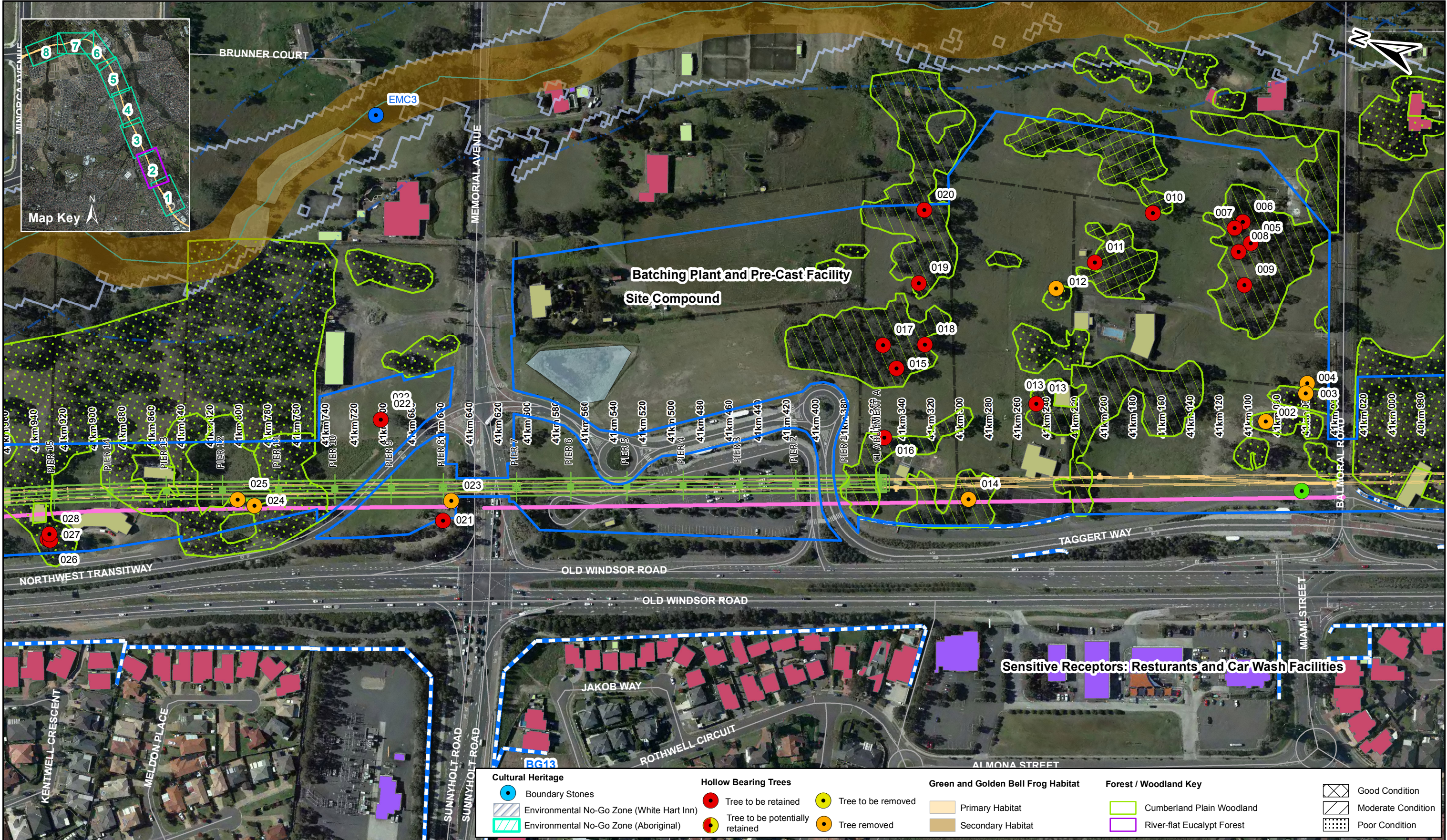
Related Documents
EIS appendices
Eco Logical Australia 2012
ISJV SVC Project Management System - MSP22T Flora and Fauna Management Procedure
Riparian Assessment for the North West Rail Link (Ecological Australia 2011)
SSI-5100 North West Rail Link: Environmental Impact Statement – Stage 1 – Major Civil Construction Works (26 March 2012)
Submissions Report, Stage 1 - Major civil Construction Works, Incorporating Preferred Infrastructure Report (July 2012)
SSI-5414 North West Rail Link: Environmental Impact Statement – Stage 2 - Stations, Rail Infrastructure and Systems (25 October 2012)
Submissions Report, Stage 2 - Major civil Construction Works
North West Rail Link, SVC Project Deed, Design and Construction of Surface and Viaduct Civil Works. Exhibit A, Scope of Works and Technical Criteria, Appendix 24 – Project Plan Requirements
References
<ul style="list-style-type: none"> • WI22T-6 Weed Control • A Field Manual for the Surveying and Mapping of Nationally Significant Weeds (McNaught, I., Thackway, R., Brown, L. and Parsons, M 2008) • Central Mapping Authority of New South Wales, 1983, Topographic Map 1:25 000 Second Edition – Riverstone 9030-I-S. • Australian Standard 4970 – 2009 Protection of Tree • Best Practice Management Guidelines for <i>Phytophthora cinnamomi</i> within the Sydney Metropolitan Catchment Management Authority Area (Suddaby, T. and Liew, E. 2008). • Control Manual for Lantana (Van Oosterhout 2004) • Cumberland Plain Recovery Plan (DECCW 2011) • Guidelines for Controlled Activities: In-stream works (DWE 2008) • Guidelines for Controlled Activities, Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries 2004) • Guidelines for Threatened Species Assessment (DEC and Department of Primary Industries 2005) • Noxious and Environmental Weed Control Handbook, 4th Edition, NSW Industry & Investment Management Guide • Policy and Guidelines for Design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures (NSW Fisheries 1999). • Policy and Guidelines for Fish Habitat Conservation and Management 2013 • Recovering Bushland on the Cumberland Plain. Best practice guidelines for the management and restoration of bushland (DECC 2005) • Survey Guidelines for Australia's Threatened Frogs (Australian Government Department of the Environment, Water, Heritage and the Arts, 2010) Australian Standard 4970–2009 Protection of trees on development sites • Threatened Biodiversity Survey and Assessment Guidelines (working draft, DEC 2004) Environmental Impact Assessment Guidelines; Cumberland Plain Large Land Snail (NSW National Parks and Wildlife Service 2000)
Revision, Control & Amendment
<p>Revisions to this plan will be made as required, as referenced in section 4.2.3 of the CEMP, and in accordance with ISJVSVC-PMS MSP18 'Document and Data Control'. The Environmental Manager will review outstanding issues and comments provided by the ER, IC, Principal's Representative or authorities and address these either:</p> <ul style="list-style-type: none"> • in time to be endorsed by the IC and reviewed by the Principal's Representative prior to commencement of any related activities or work. • at the next Management Review of the plan as outlined in the Project Management Plan.

Construction Flora and Fauna Management Plan


Surface and Viaduct Civil Works



APPENDIX 1: Sensitive Area Maps



B	01/04/14	TP	Updated hollow bearing trees to be retained and surface water monitoring locations	DM	TA
A	01/04/14	BH	Draft Issue for comment	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					



Surface Water Monitoring

- Downstream
- Upstream
- Piezo Sample Location
- Flood Modelling: 20 Year
- River / Creek
- Second Ponds Crk 50m buffer
- Riparian Buffer
- Water body

Hollow Bearing Trees

- Tree to be retained
- Tree to be potentially retained
- Tree to be removed
- Tree removed

Green and Golden Bell Frog Habitat

- Primary Habitat
- Secondary Habitat

Forest / Woodland Key

- Cumberland Plain Woodland
- River-flat Eucalypt Forest

Good Condition

- Moderate Condition
- Poor Condition

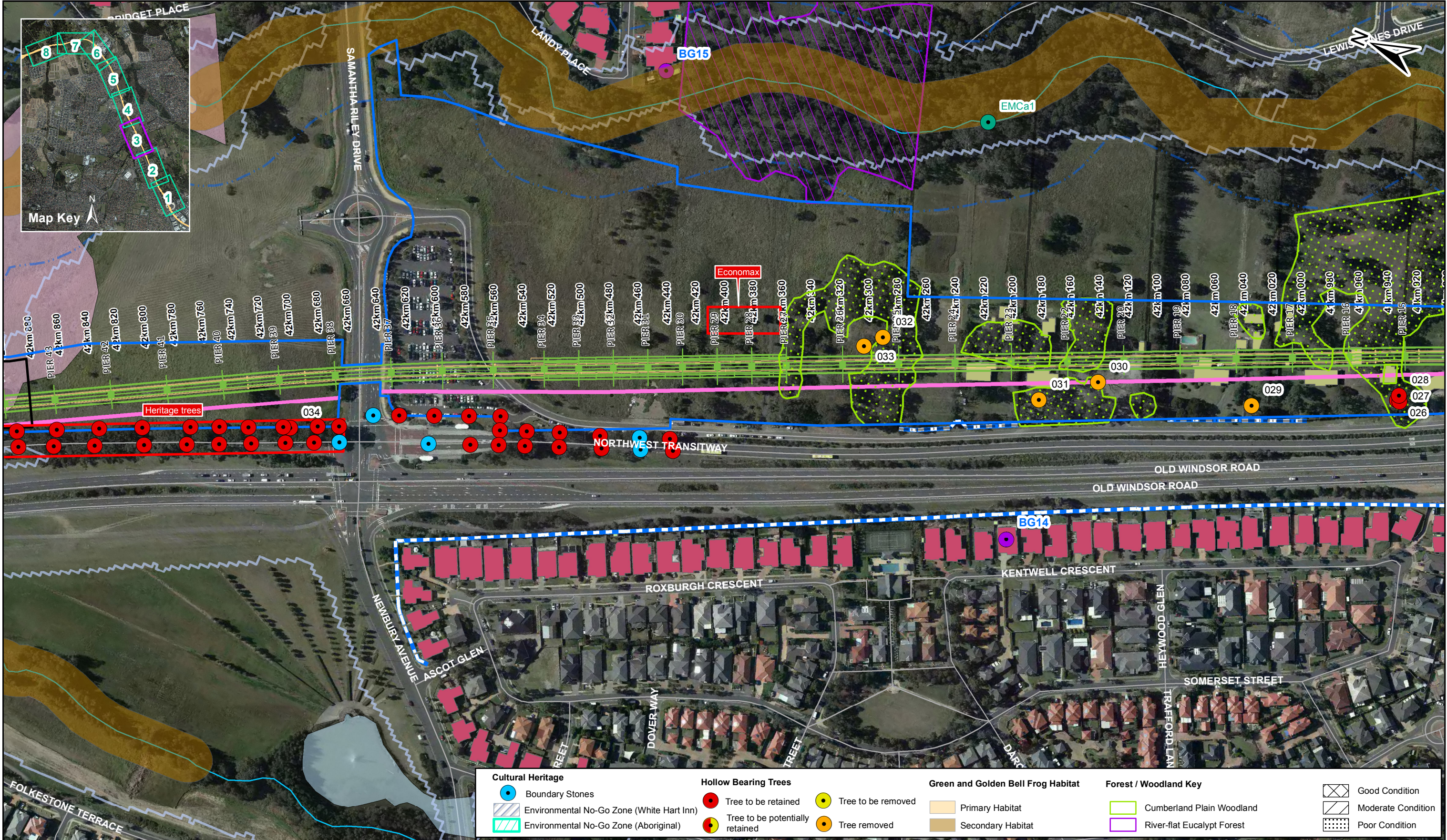
Buildings and Use

- Residential
- Shed / Carport / Garage
- Commerical
- School
- Building Identified for Acquisition


Other

- Terry Road storage area
- Demolition Register
- Existing Noise Barrier / Fence
- Haulage Road
- Concept Alignment: EIS2Sub
- Project Boundary
- No-Go Zone
- Sydney Water Stages 1 & 2
- Sydney Water Land
- Rail Tunnel Corridor

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: TP	DATE: September 2015
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 9/10: Balmoral to Memorial	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Metres	
TITLE: Concept alignment (EIS2Sub) dated 13 October 2010, Sensitive Layers	DRAWING No: FIGURE 2	REV: H



B	01/04/14	TP	Updated hollow bearing trees to be retained and surface water monitoring locations	DM	TA
A	01/04/14	BH	Draft Issue for comment	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					



Surface Water Monitoring

- Downstream
- Upstream
- Piezo Sample Location
- Flood Modelling: 20 Year
- River / Creek
- Second Ponds Crk 50m buffer
- Riparian Buffer
- Water body

Hollow Bearing Trees

- Tree to be retained
- Tree to be potentially retained
- Tree to be removed
- Tree removed

EIS Noise Monitoring Location

- Existing Noise Barrier / Fence
- Haulage Road
- Concept Alignment: EIS2Sub
- Project Boundary
- No-Go Zone
- Sydney Water Stages 1 & 2
- Sydney Water Land
- Rail Tunnel Corridor

Buildings and Use

- Residential
- Shed / Carport / Garage
- Commercial
- School
- Building Identified for Acquisition

Terry Road storage area


- Demolition Register

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: TP	DATE: September 2015
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 11: Kellyville	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Metres	
TITLE: Concept alignment (EIS2Sub) dated 13 October 2010, Sensitive Layers	DRAWING No: FIGURE 3	REV: H

031038 Sensitive area map _v6_150915



B	01/04/14	TP	Updated hollow bearing trees to be retained and surface water monitoring locations	DM	TA
A	01/04/14	BH	Draft Issue for comment	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					



Surface Water Monitoring

- Downstream
- Upstream
- Piezo Sample Location
- Flood Modelling: 20 Year
- River / Creek
- Second Ponds Crk 50m buffer
- Riparian Buffer
- Water body

Hollow Bearing Trees

- Tree to be retained
- Tree to be potentially retained
- Tree to be removed
- Tree removed

EIS Noise Monitoring Location

- Existing Noise Barrier / Fence
- Haulage Road
- Concept Alignment: EIS2Sub
- Project Boundary
- No-Go Zone
- Sydney Water Stages 1 & 2
- Sydney Water Land
- Rail Tunnel Corridor

Buildings and Use

- Residential
- Shed / Carport / Garage
- Commerical
- School
- Building Identified for Acquisition

Green and Golden Bell Frog Habitat

- Primary Habitat
- Secondary Habitat

Forest / Woodland Key

- Cumberland Plain Woodland
- River-flat Eucalypt Forest

Condition Key

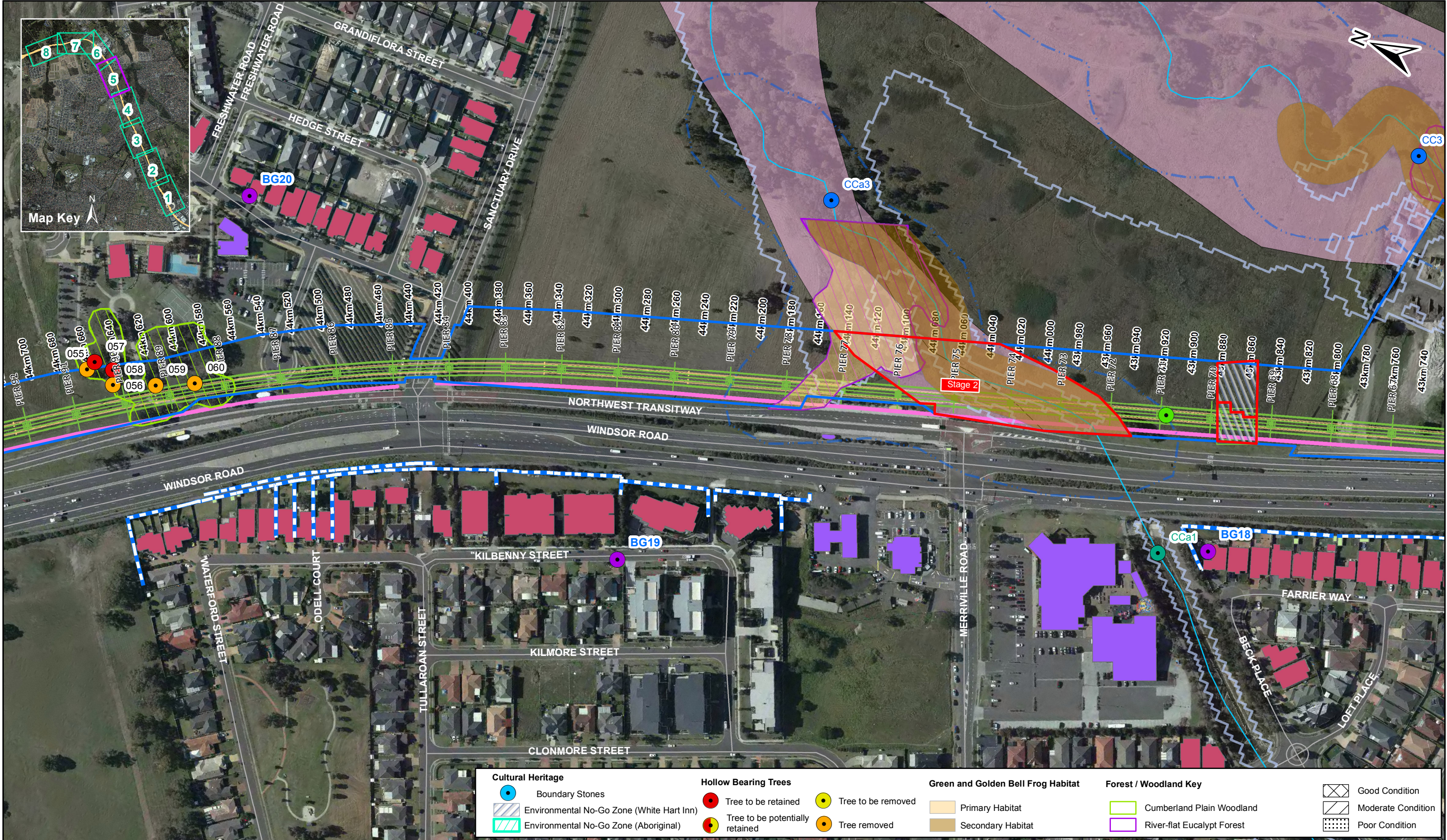
- Good Condition
- Moderate Condition
- Poor Condition

Terry Road storage area

- Demolition Register

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: TP	DATE: September 2015
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 12: SR Drv to Windsor Rd	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Metres	
TITLE: Concept alignment (EIS2Sub) dated 13 October 2010, Sensitive Layers	DRAWING No: FIGURE 4	REV: H

031038 Sensitive area map _v6_150915



B	01/04/14	TP	Updated hollow bearing trees to be retained and surface water monitoring locations	DM	TA
A	01/04/14	BH	Draft Issue for comment	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					



Surface Water Monitoring <ul style="list-style-type: none">DownstreamUpstreamPiezo Sample LocationFlood Modelling: 20 YearRiver / CreekSecond Ponds Crk 50m bufferRiparian BufferWater body	Hollow Bearing Trees <ul style="list-style-type: none">Tree to be retainedTree to be potentially retainedTree to be removedTree removed	Green and Golden Bell Frog Habitat <ul style="list-style-type: none">Primary HabitatSecondary Habitat	Forest / Woodland Key <ul style="list-style-type: none">Cumberland Plain WoodlandRiver-flat Eucalypt Forest	Buildings and Use <ul style="list-style-type: none">ResidentialShed / Carport / GarageCommericalSchoolBuilding Identified for Acquisition
Cultural Heritage <ul style="list-style-type: none">Boundary StonesEnvironmental No-Go Zone (White Hart Inn)Environmental No-Go Zone (Aboriginal)	Surface Water Monitoring <ul style="list-style-type: none">DownstreamUpstreamPiezo Sample LocationFlood Modelling: 20 YearRiver / CreekSecond Ponds Crk 50m bufferRiparian BufferWater body	Hollow Bearing Trees <ul style="list-style-type: none">Tree to be retainedTree to be potentially retainedTree to be removedTree removed	Green and Golden Bell Frog Habitat <ul style="list-style-type: none">Primary HabitatSecondary Habitat	Forest / Woodland Key <ul style="list-style-type: none">Cumberland Plain WoodlandRiver-flat Eucalypt Forest
Buildings and Use <ul style="list-style-type: none">ResidentialShed / Carport / GarageCommericalSchoolBuilding Identified for Acquisition	Buildings and Use <ul style="list-style-type: none">ResidentialShed / Carport / GarageCommericalSchoolBuilding Identified for Acquisition	Buildings and Use <ul style="list-style-type: none">ResidentialShed / Carport / GarageCommericalSchoolBuilding Identified for Acquisition	Buildings and Use <ul style="list-style-type: none">ResidentialShed / Carport / GarageCommericalSchoolBuilding Identified for Acquisition	Buildings and Use <ul style="list-style-type: none">ResidentialShed / Carport / GarageCommericalSchoolBuilding Identified for Acquisition

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: TP	DATE: September 2015
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 13: Old Windsor Rd to WHD	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Metres	
TITLE: Concept alignment (EIS2Sub) dated 13 October 2010, Sensitive Layers	DRAWING No: FIGURE 5	REV: H



B	01/04/14	TP	Updated hollow bearing trees to be retained and surface water monitoring locations	DM	TA
A	01/04/14	BH	Draft Issue for comment	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					

Surface Water Monitoring

- Downstream
- Upstream
- Piezo Sample Location
- Flood Modelling: 20 Year
- River / Creek
- Second Ponds Crk 50m buffer
- Riparian Buffer
- Water body

Hollow Bearing Trees

- Tree to be retained
- Tree to be potentially retained
- Tree to be removed
- Tree removed

EIS Noise Monitoring Location

- Existing Noise Barrier / Fence
- Haulage Road
- Concept Alignment: EIS2Sub
- Project Boundary
- No-Go Zone
- Sydney Water Stages 1 & 2
- Sydney Water Land
- Rail Tunnel Corridor

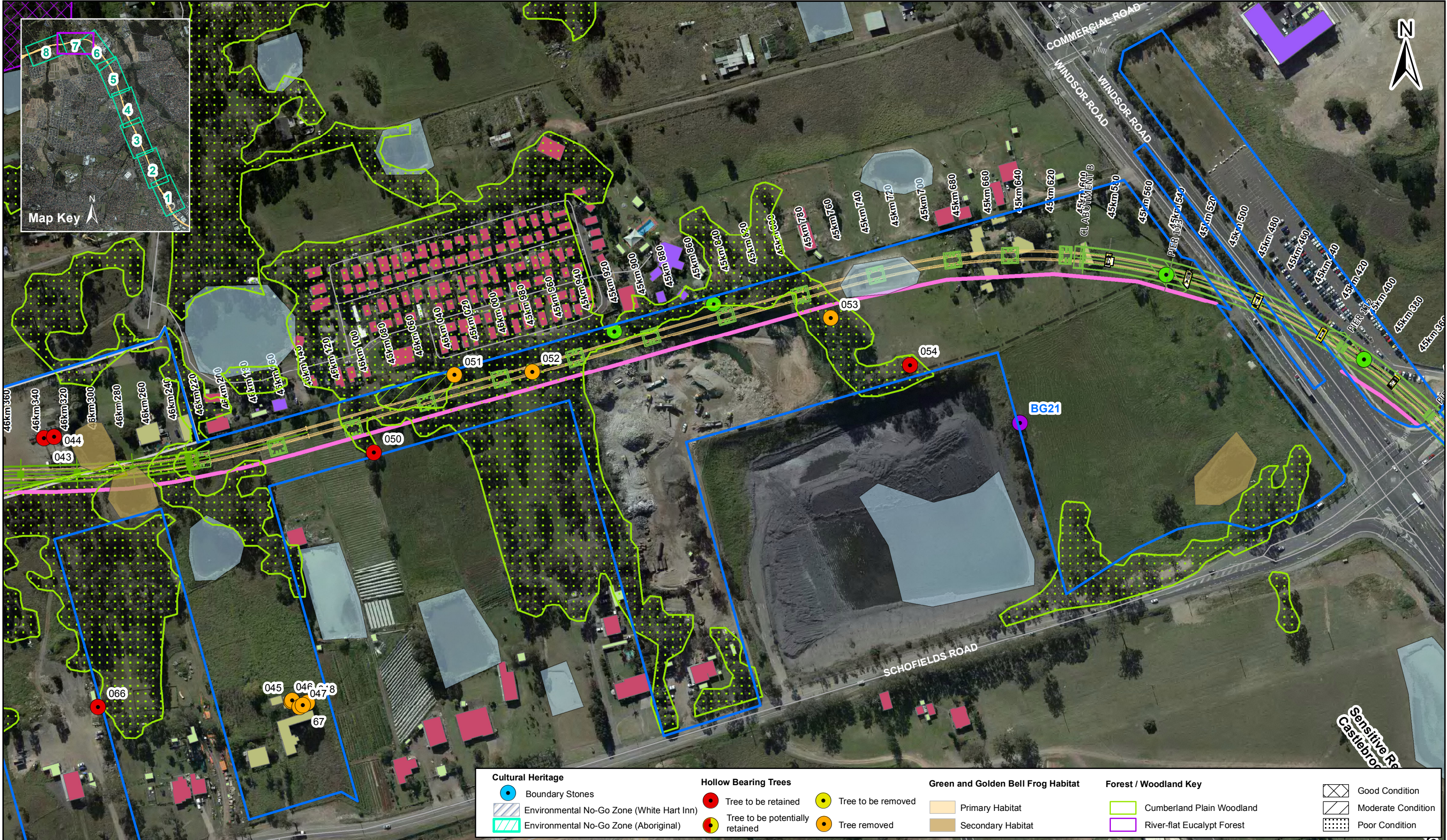
Terry Road storage area

- Demolition Register


Buildings and Use

- Residential
- Shed / Carport / Garage
- Commerical
- School
- Building Identified for Acquisition

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: TP	DATE: September 2015
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 14: Rouse Hill	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Metres	
TITLE: Concept alignment (EIS2Sub) dated 13 October 2010, Sensitive Layers	DRAWING No: FIGURE 6	REV: H



B	01/04/14	TP	Updated hollow bearing trees to be retained and surface water monitoring locations	DM	TA
A	01/04/14	BH	Draft Issue for comment	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					



Cultural Heritage

- Boundary Stones
- Environmental No-Go Zone (White Hart Inn)
- Environmental No-Go Zone (Aboriginal)

Hollow Bearing Trees

- Tree to be retained
- Tree to be potentially retained
- Tree to be removed
- Tree removed

Green and Golden Bell Frog Habitat

- Primary Habitat
- Secondary Habitat

Forest / Woodland Key

- Cumberland Plain Woodland
- River-flat Eucalypt Forest

Surface Water Monitoring

- Downstream
- Upstream
- Piezo Sample Location
- Flood Modelling: 20 Year
- River / Creek
- Second Ponds Crk 50m buffer
- Riparian Buffer
- Water body

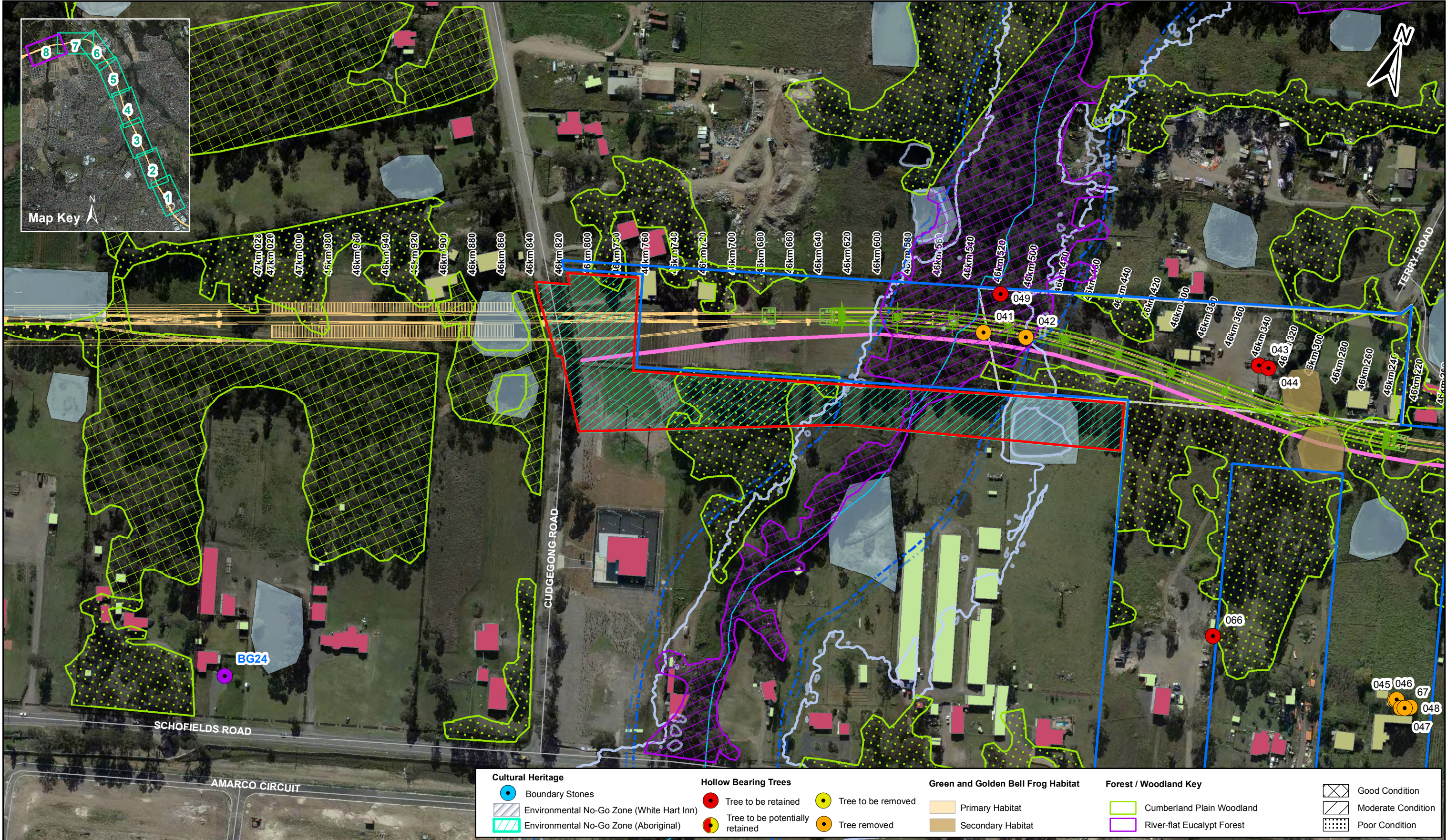
EIS Noise Monitoring Location

- Existing Noise Barrier / Fence
- Haulage Road
- Concept Alignment: EIS2Sub
- Project Boundary
- No-Go Zone
- Sydney Water Stages 1 & 2
- Sydney Water Land
- Rail Tunnel Corridor


Buildings and Use

- Terry Road storage area
- Demolition Register
- Residential
- Shed / Carport / Garage
- Commercial
- School
- Building Identified for Acquisition

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: TP	DATE: September 2015
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 15: Windsor Rd Viaduct	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Metres	
TITLE: Concept alignment (EIS2Sub) dated 13 October 2010, Sensitive Layers	DRAWING No: FIGURE 7	REV: H



B	01/04/14	TP	Updated hollow bearing trees to be retained and surface water monitoring locations	DM	TA
A	01/04/14	BH	Draft Issue for comment	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					



Surface Water Monitoring

- Downstream
- Upstream
- Piezo Sample Location
- Flood Modelling: 20 Year
- River / Creek
- Second Ponds Crk 50m buffer
- Riparian Buffer
- Water body

Hollow Bearing Trees

- Tree to be retained
- Tree to be potentially retained
- Tree to be removed
- Tree removed

EIS Noise Monitoring Location

- Existing Noise Barrier / Fence
- Haulage Road
- Concept Alignment: EIS2Sub
- Project Boundary
- No-Go Zone
- Sydney Water Stages 1 & 2
- Sydney Water Land
- Rail Tunnel Corridor

Buildings and Use

- Residential
- Shed / Carport / Garage
- Commerical
- School
- Building Identified for Acquisition

Terry Road storage area

- Demolition Register

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: TP	DATE: September 2015
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 16: WR Via to Cudgegong Rd	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Metres	
TITLE: Concept alignment (EIS2Sub) dated 13 October 2010, Sensitive Layers	DRAWING No: FIGURE 8	REV: H

APPENDIX 2: Fauna Handling and Rescue Procedure

Fauna Handling and Rescue Procedure

Handling of fauna may be necessary when they are encountered and need to be relocated or, if injured, taken to a vet or wildlife carer. Fauna handling should be undertaken either by a licensed fauna spotter or wildlife carer skilled in handling the type of fauna encountered.

General Requirements

- All fauna capture and relocation will be undertaken by a qualified fauna spotter working under an appropriate permit issued by OEH.
- Contractor induction must be provided and is to include relevant sections of this procedure and other fauna management issues and obligations under the CFFMP to not interfere with or harm fauna.
- All potential fauna habitat (for example hollow-bearing trees, dens, dreys, nests etc.) should be identified prior to removal. Fauna habitat trees/vegetation should be marked "H" with paint. Other potential fauna habitat should be marked with appropriate flagging tape. This should be undertaken in advance of habitat removal.
- On the day of habitat removal, the fauna spotter will inspect the area for any fauna that may be impacted.
- All fauna observed, captured, relocated, injured or killed during the habitat removal phase of the project must be recorded by the fauna spotter and a Fauna Relocation Record Form and Ecologist Inspections Records completed. The following data should be recorded; date, species, sex (if known), location of observation (easting/northings), location of release site (including any nest boxes installed; easting/northings), notes regarding deposit of fauna to veterinarian or wildlife shelter and any other relevant notes. This data is to be supplied to OEH by the fauna spotter.
- All fauna requiring to be relocated will be relocated into adjacent suitable habitat as close as practical to the point of capture. Usually this is within 50 meters of the capture location, but no more than 150 meters.
- Depending on the fauna encountered and/or during construction or vegetation removal when fauna may become evident, the fauna spotter will determine if capture and relocation is warranted, based on the best interests (animal welfare interests) of the animal concerned.
- For any threatened species that are encountered, advice from OEH should be sought prior to relocation. Works may need to cease, pending advice from OEH.
- If the fauna spotter determines that construction or tree removal is to cease so that fauna may be safely captured and relocated, the fauna spotter is to liaise with the site manager and/or the appropriate contractor(s).
- Fauna in hollows should be extracted by hand from the hollow. This may require cutting the entrance of the hollow with a chainsaw. Extreme care is advised. If a chainsaw must be used to increase the entrance size, it is strongly recommended that a suitable plug (for example, several scrunched-up cloth capture bags or towels), be placed between the animal and the chainsaw. Care must be taken not to injure the animal during the extraction process. Firm but gentle pressure should be applied, to encourage the animal from the hollow. The use of an inverted cloth capture bag is recommended if appropriate to the circumstance, so that when the animal is extracted, the bag can be pulled over the animal immediately.
- If nocturnal fauna is required to be kept during the day, they will be kept in either standard pet carrying cages or ventilated cardboard/plastic animal boxes, or cloth capture bags. Captive fauna will generally be kept in ambient temperature and shaded conditions to avoid any heat stress. Water will be provided if necessary. Injured fauna may require external heat. The fauna spotter is to regularly monitor captive fauna.
- In the event that juvenile fauna is displaced and cannot be re-united with its parent(s), orphaned fauna must be deposited with an authorised wildlife shelter within the region for hand rearing.
- In the event that fauna is injured during construction, the removal of trees, or during hand capture, the animal should initially be assessed and first aid rendered by experienced fauna spotter and

subsequently taken to a Veterinarian for further assessment and treatment and if necessary euthanasia.

- After consultation with the veterinarian, injured fauna that requires recuperation and thus is unable to be immediately released must be deposited with an authorised wildlife shelter. Upon successful recuperation and rehabilitation, the animal is to be released into suitable habitat as close as is practical to the point of original capture.
- At all times, the welfare of individual animals must be of utmost concern to all involved in this protocol.
- A severely injured animal (for example, deep cut with exposed organs, bone fracture, protruding bone etc) may require euthanasia. It is preferable to take animals to a veterinarian for euthanasia however, at times this may not be possible, practical or in the best interests of the animal (i.e. prolonged suffering). In these cases it may be necessary to undertake euthanasia in the field. The method of euthanasia should be suited to the size of the animal. In general, a sharp and forceful blow to the head with a blunt object (e.g. hammer) to cause instantaneous death is considered to be humane. For larger animals such as macropods, a firearm may need to be used. Only experienced and authorised fauna spotters are to perform euthanasia in the field.

Specific requirements

Birds

Salvage approach:

- Where possible and safe to do so, gain access to nests using elevated platform/ladder. Capture and remove any nestlings, taking care not to be bitten or scratched (gloved hands may be appropriate for some species such as raptors and parrots).
- Place nestlings in cotton capture bags and assess for injuries. Store bags containing nestlings in a pet carrying cage or ventilated cardboard box. The animal container should be covered to reduce stress on the bird. Deliver to specialist wildlife carer within two hours.
- If adult birds are captured, they will be released immediately away from construction activities.

Ground-dwelling mammals

Species: Echidna

Salvage approach:

- If echidnas are found within the construction zone or during habitat removal, they will need to be captured and relocated.
- Dig Echidna out by hand or carefully by shovel to the side of the echidna. The aim is to get a hand(s) beneath the echidna and to grasp a hind leg(s) and lift the echidna from the soil.
- Place in a dig-proof container, such as a ventilated plastic box or garbage bin. Captive echidnas should be kept in a cool, well ventilated location, out of direct sun. Uninjured echidnas should be translocated and released as soon as possible. Upon release, they may dig in. Observe the animal from a distance to ensure it moves off freely and away from any roads.

Species: Native rodents

Salvage approach:

- Capture rodents using a hand net.
- Once captured, rodents should be placed into a cloth capture bag, assessed and if not injured, retained until dusk and then released into appropriate habitat.

Species: Kangaroos and wallabies (macropods)

Salvage approach:

- Only experienced personnel should deal with macropods

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



- Impacts on kangaroos and wallabies include entanglement in boundary fencing ('fence hangers'), and stressed individuals being disturbed by construction activities.
- Project boundary fences should be checked each morning by construction personnel. This can be undertaken by construction personnel. If a fence hanger is observed by construction personnel, they must immediately notify the fauna spotter.
- If a macropod is within the construction zone, activities in the area may need to cease. The fauna spotter should be notified immediately.
- In the event that a juvenile macropod is displaced (thrown from a pouch) and cannot be re-united with its parent, orphaned macropods must be deposited with an authorised wildlife shelter within the region for hand rearing within 2 hours.

Reptiles

Species: Snakes, lizards, turtles

Salvage approach:

- Snakes can only be captured by an experienced fauna spotter or licensed snake handler. Snakes disturbed by the development should only be captured and relocated if they present a potential threat to construction personnel or are likely to be harmed by the works. In most cases, snakes will attempt to move away from a disturbed area.
- Reptiles can be captured either by hand or nets; snakes can be captured using specialist hooks and grippers.
- Reptiles should be placed into cloth capture bags or ventilated plastic containers.
- Reptiles should be released as soon as possible after capture into suitable habitat outside of the construction zone.

Frogs

Salvage approach:

- Frog searches are to be conducted by the fauna spotter prior to any excavation/construction activities.
- The capture and relocation of frogs require specific attention to avoid disease transmission. The following hygiene protocol applies:
 - a. Capture, handling and housing of wild frogs should be minimised or avoided where possible
 - b. Single-use Latex, nitrile or vinyl gloves or single-use plastic bags should be used at all times when handling/capturing frogs.
 - c. New gloves need to be used for each new frog handled.
 - d. hand washing with 70% ethanol (allowing hands to dry) between handling individual frogs is acceptable if no gloves are available (note, repeated use on human skin is not recommended). Alcohol is toxic to frogs so hands must be washed thoroughly in water after treatment with alcohol.
 - e. Each frog must be housed separately in plastic zip lock bags (with air holes punched into the bag prior to frog capture). Bagged frogs must be kept in a cool quiet location and released into suitable habitat at the earliest opportunity (immediate release ideal or release before night fall on the day of capture).
 - f. No plastic bag is to be re-used and must be disposed of after a single use.
 - g. When moving between water bodies/wetlands, personnel should wash their boots in foot baths going from and into water bodies/wetlands. Foot baths are to consist of the following; plain water bath and 10% bleach solution bath. Personnel are to first wash their boots in plain water to remove any soil, followed by washing in 10% bleach.

Arboreal mammals

Species: Koala

Salvage approach:

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



- Trees in which Koalas are present must not be felled and must be clearly marked with paint or flagging tape.
- Vegetation surrounding the Koala tree should be cleared without disturbance to the Koala.
- If possible the Koala tree must be left undisturbed for 24 hours. If at the end of this time the Koala has not moved on, it may be necessary to capture and relocate the Koala. Depending on how high the Koala is, it may be necessary to engage a tree climber to coax the Koala down the tree.
- Captured Koalas should be placed in a suitable animal cage.
- The Koala should be transported to the nearest suitable habitat outside of the construction zone for release.
- In the event that a juvenile Koala is displaced and cannot be re-united with its parent, orphaned Koalas must be deposited with an authorised wildlife shelter within the region for hand rearing within 2 hours.

Species: Possums and gliders

Salvage approach:

- The fauna spotter is to be on site during the removal of vegetation and to inspect trees for possums and gliders that may need to be relocated.
- If possums and gliders are found during vegetation clearing, the fauna spotter will determine if capture and relocation is warranted.
- Captured possums and gliders will be released no more than 150 metres from point of capture.
- Once a hollow felled, it should be inspected for Possums and gliders.
- Possums and gliders should be captured either by hand or net and placed into a suitable cage.
- Gliders should be held in cloth capture bags.
- Possums and gliders are to be released into a suitable hollow or nest box within the identified release location as soon as is practical after capture.
- In the event that juvenile possums/gliders are displaced and cannot be re-united their mother, they must be deposited with an authorised wildlife shelter within the region for hand rearing within 2 hours.

Microbats

Species: All species.

Salvage approach:

- There is potential for microbats to carry the Australian Bat Lyssavirus (a rabies like virus), a disease potentially fatal to humans. To reduce the risk of infection, only experienced and vaccinated personnel are to handle microbats.
- The fauna spotter is to be on site during the removal of vegetation and to inspect trees for microbats that may need to be relocated.
- Once a tree or section of tree of interest is on the ground, the fauna spotter should inspect hollows, cracks and loose bark for microbats.
- Microbats will be captured by hand using protective gloves.
- Captured microbats must immediately be placed into a cloth bag hung vertically in a quiet, cool, dark place until released.
- All captured microbats will be relocated into adjacent suitable habitat within 150 meters of the capture point.
- Microbats captured are to be released into a suitable hollow or nest box within the identified release location as soon as is practical after capture.
- If microbats go into torpor, they will need to be roused, prior to release. This can be achieved by closely holding the bat in the hand or under clothing.

Construction Flora and Fauna Management Plan

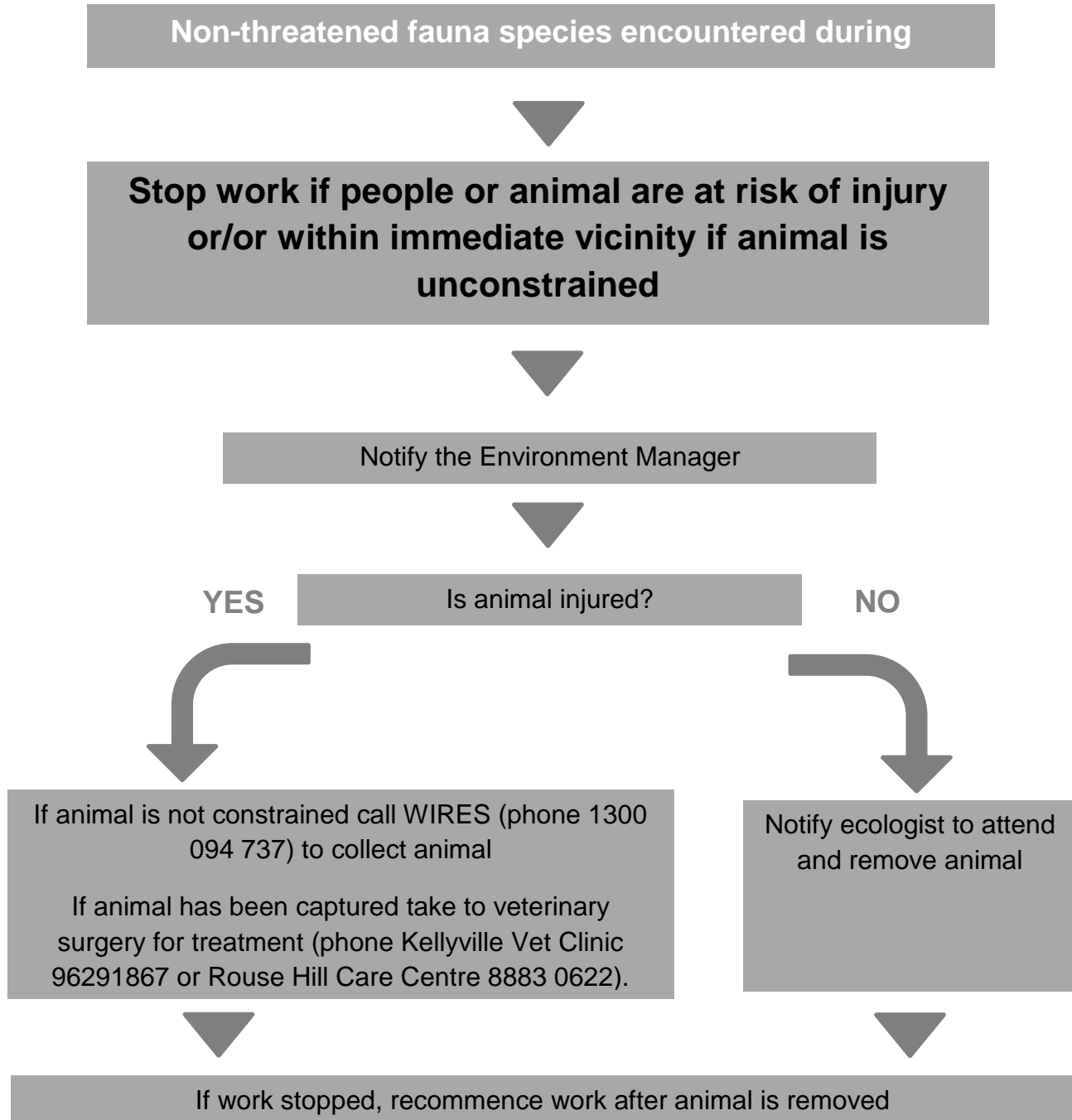
Surface and Viaduct Civil Works



- In the event that a juvenile microbat is displaced and cannot be re-united with its parent, orphaned microbats must be deposited with an authorised wildlife shelter within the region for hand rearing or a specialist care facility within 2 hours.

Handling Procedure

Procedure to be undertaken by all site personnel for **non-threatened fauna species** encountered on site during construction.



Fauna Relocation Record

Management System Form



Project:

Date:

FRR No:

Located by:

Company:

Phone No:

Area located:

Chainage/GPS

If this relocation follows a Tree Inspection enter MSF22T-1 Tree Inspection Record no:

GENERAL

What is the species of animal?

Time located/reported:

Is it a juvenile?

Is it injured?

NOTE: Fauna should only be handled by a licenced ecologist, wildlife carer or vet.

INJURIES

Describe injury:

Time wildlife carer/vet contacted:

Outcome of contact:

NOTE: Where possible, allow fauna to leave the area without intervention

RELOCATION

Who was contacted to relocate the animal?

Phone:

Is a valid NPWS licence held?

What time was the fauna rescue agency ecologist called?

What time did the fauna rescue agency/ecologist arrive?

Where was the animal released/relocated?

Comments

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



Tree Inspection Record



Management System Form

Project:	Date:	TIR No:
Inspected by:	Company:	Phone no:
Tree Species:	Tree ID number:	GPS/Chainage:

HOLLOWS

Type (branch/limb/trunk):	
Size (small/medium/large):	Approx. height from ground:
Fauna species inhabiting hollow (if any)	

OTHER FAUNA

Are there any nests in the tree?
Bird species (if present)
Any other fauna associated with the tree

If any fauna present complete MSF22T-2 Fauna Relocation Record (FRR No.:)

THREATENED FLORA

Does the tree support any rare or threatened epiphytic flora (e.g. orchids, ferns, bromeliads)?
Does the tree support any rare or threatened parasitic flora (e.g. mistletoe)?
List any rare or threatened species present

NOTE: All habitat trees must be removed by staged clearing

Removal of Tree Approved By:

Name:	Position:
Company:	
Signature:	Date:

APPENDIX 3: Vegetation Pre-Clearing Procedure

Pre-clearing procedure

The pre-clearing process provides a final check for any threatened flora or fauna species that may have moved into the area since undertaking previous surveys. This is particularly important where the season or prevailing weather conditions influence whether a species is found in an area.

The pre-clearing process:

1. Review Appendix 1 for sensitive area mapping to determine locations of; riparian areas or threatened flora, fauna and EECs that need to be considered during the pre-clearing process.
2. The ecologist to undertake the following procedure in the weeks before clearing begins:
 - a. Confirm the locations of sensitive area mapping as per Appendix 1.
 - b. Identify any fauna that have the potential to be disturbed, injured or killed as a result of clearing activities (e.g. nesting birds).
 - c. Check for the presence of threatened flora and fauna species identified Appendix 1. This check should be undertaken during optimal weather conditions, season and time of day/night for identifying targeted flora and fauna species.
 - d. If not already available, record the details for all hollow-bearing trees, trees containing threatened fauna and threatened flora, including (where applicable):
 - GPS location.
 - Species.
 - Type of habitat feature (e.g. nest, bushrock).
 - Size of hollow (e.g. small, medium, large).
 - Type of hollows (e.g. branch, limb, trunk).
 - e. Provide input and mark habitat features to be protected during construction. Use suitable methods (e.g. flagging tape) to mark:
 - All hollow-bearing trees or habitat features.
 - Any trees found to contain threatened fauna.
 - The location of any threatened flora.
 - f. Identify and confirm the location of pre-determined habitat identified for the release of any fauna encountered on site.
 - g. Submit any updated maps/plans, pre-determined habitat for the release of fauna, habitat features and recommended clearing procedures to the project manager and/or environment manager (or equivalent).
3. Where native vegetation is to be retained adjacent to or within construction sites, protective fencing and signage would be installed in accordance with Australian Standard 4970 – 2009 Protection of Tree. In addition to fencing area to be marked with flagging tape (red) and signage added to indicate areas or trees to be protected.
4. Appendix 5 (Unexpected EEC/threatened species procedure) to be followed if additional records or new species are identified by an ecologist or site worker.
5. The following procedure should be followed 24 hours before clearing:
 - a. Licensed wildlife carers and/or ecologists should capture and/or remove fauna that have the potential to be disturbed, injured or killed as a result of clearing activities. Relocate captured fauna into pre-determined habitat identified for fauna release (see Appendix 2: Fauna Handling and Rescue Procedure).
 - b. The site supervisor or environment manager should inform clearing contractors of any changes to the sequence of clearing if required. Carry out staged habitat removal where fauna habitat features (such as hollow-bearing trees, habitat trees and bushrock) have been identified and marked.

APPENDIX 4: Weed Management Procedure

Weed Management Procedure

Most of the study area has moderate to high levels of weed invasion due to disturbance from stormwater, vegetation clearance, and edge effects.

Of the 156 exotic weed species recorded in the study area, 26 are declared noxious weeds within the Hornsby, The Hills and Blacktown LGAs. Noxious weed species, their class under the *Noxious Weeds Act, 1993* and control methods are recorded in Table 1.

Table 1: Noxious weeds and control techniques

Species	Common Name	Class	The Hills LGA	Blacktown LGA	Control Information
<i>Alternanthera philoxeroides</i>	Alligator Weed	3	X	X	
<i>Lycium ferocissimum</i>	African Boxthorn	4	X	X	Mechanical removal followed by disposal or burning, herbicide application – foliar spray, basal bark treatment, cut stump treatment, root application
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	4	X	X	Mechanical removal or herbicide application – cut and paint stump, drill and inject, foliar spray, basal bark spray
<i>Asparagus aethiopicus</i>	Asparagus Fern	4	X	X	Mechanical removal or herbicide application – foliar spray
<i>Cardiospermum grandiflorum</i>	Balloon Vine	4			Mechanical removal or herbicide application – foliar spray
<i>Rubus fruticosus</i> (agg.)	*Blackberry	4	X	X	Mechanical removal or herbicide application – foliar spray
<i>Chrysanthemoides monillifera</i> subsp. <i>monillifera</i>	*Boneseed	4	X	X	Mechanical removal or herbicide application – cut and paint stump, foliar spray
<i>Asparagus asparagoides</i>	*Bridal Creeper	4	X	X	Mechanical removal or herbicide application – foliar spray
<i>Cinnamomum camphora</i>	Camphor laurel	4			Mechanical removal or herbicide application – cut and paint stump, drill and inject
<i>Asparagus plumosus</i>	Climbing Asparagus Fern	4	X	X	Mechanical removal or herbicide application – foliar spray
<i>Cestrum parqui</i>	Green Cestrum	3	X	X	Mechanical removal or herbicide application – foliar spray
<i>Lantana</i> spp.	*Lantana	4	X	X	Mechanical removal
<i>Ludwigia peruviana</i>	*Peruvian Primrose	3	X	X	Mechanical removal or herbicide application – foliar spray
<i>Bryophyllum</i> spp.	Mother-of-millions	3	X	X	Mechanical removal or herbicide application – foliar spray

Species	Common Name	Class	The Hills LGA	Blacktown LGA	Control Information
<i>Echium</i> spp.	Paterson's Curse	4	X	X	Mechanical removal or herbicide application – foliar spray
<i>Opuntia</i> spp.	Prickly Pear	4	X	X	Mechanical removal
<i>Ligustrum lucidum</i>	Privet (Broad-leaf)	4	X	X	Mechanical removal or herbicide application – cut and paint stump, drill and inject
<i>Ligustrum sinense</i>	Privet (Narrow-leaf)	4	X	X	Mechanical removal or herbicide application – cut and paint stump, drill and inject.
<i>Hypericum perforatum</i>	St. John's Wort	4	X	X	Mechanical removal or herbicide application – foliar spray.

Control Procedures

Broad techniques for the control of noxious weeds suitable for the study area are outlined below. All control methods will require follow up treatment for effective long-term management. If the weed infestation is providing a valuable habitat for native fauna, use a staged control program. This will allow the gradual replacement of the weed habitat with suitable indigenous vegetation.

All weed control to be undertaken by a qualified and licensed chemical applicator, with experience in controlling the above listed weeds at the appropriate seasonal timeframe and with the appropriate control method as outlined above.

Mechanical Control

The primary means of weed control for the SMNW SVC project will be to mechanically remove noxious weeds with appropriate plant at the initial stages of construction with bob cat and dozer type machinery, due ease and speed of removal.

Care to be taken so to not damage remnant native trees and vegetation and to avoid causing erosion and sediment issues near waterways communities as mapped in Appendix 1.

Chemical Control

In some situations herbicides offer the only practical, cost-effective and selective method of managing certain weeds and would be undertaken by appropriately licensed operators/contractors. There are several techniques that can be used to apply herbicides. Some of the most common as prescribed in the above table, are outlined below. Chemical usage to be done so in accordance with the NSW *Pesticides Regulation 2009*.

Foliar spraying

Dilute herbicide with water or another diluent as specified on the product label, and spray over foliage to point of runoff (until every leaf is wetted, but not dripping). The method is most suited to shrubs,

grasses and dense vines less than 6 m tall so that complete coverage is achieved. Advantages include speed and economy. Disadvantages include the potential for spray drift and off-target damage.

Foliar spraying can be done in a number of ways, depending on the size of the weed plant or the infestation. Blanket spraying, using a boom spray from a tractor or aircraft, can be used to treat areas completely infested with weeds, especially with selective herbicides.

For large infestations that need targeted applications of herbicide, a hose and handgun can be used to spray solution from a herbicide tank and pump carried by a tractor or vehicle. Smaller infestations can be sprayed using a backpack/knapsack spray unit. Spot spraying is used to treat individual weed plants or areas that only have small clumps of weed infestations.

Stem injection/Drilling

Stem injection involves drilling or cutting through the bark into the sapwood tissue in the trunks of woody weeds and trees. Herbicide is immediately placed into the hole or cut. The aim is to reach the sapwood layer just under the bark (the cambium growth layer), which will transport the chemical throughout the plant.

It is essential to apply the herbicide immediately (within 15 seconds of drilling the hole or cutting the trunk), as stem injection relies on the active uptake and growth of the plant to move the chemical through its tissue.

Stem injection methods kill the tree or shrub where it stands, and only trees and shrubs that can be safely left to die and rot should be treated this way. If the tree or shrub is to be felled, allow it to die completely before felling. The use of chainsaws, particularly in the felling of trees, is a dangerous activity that should only be undertaken by an appropriately trained person.

One method is the 'drill and fill method' also referred to as tree injection, and is used for trees and woody weeds with stems or trunks greater than 5 cm in circumference. A battery-powered drill is used to drill downward-angled holes into the sapwood about 5 cm apart. The placement of herbicide into the hole is usually made using a backpack reservoir and syringe that can deliver measured doses of herbicide solution.

Another method is the 'axe cut method' which involves cutting through the bark into the sapwood tissue in the trunk, and immediately placing herbicide into the cut. This method can be used for trees and woody weeds with stems or trunks greater than 5 cm in circumference. Using an axe or tomahawk, cuts are made into the sapwood around the circumference of the trunk at waist height. While still in the cut, the axe or tomahawk is leaned out to make a downward angled pocket which will allow herbicide to pool. The herbicide is then immediately injected into the pocket. Cuts should be made no further than 3 cm apart. This method of using an axe to make the cut is often referred to as frilling or chipping. A hammer and chisel can be used to make the pocket cuts, or a spear to make cuts in the trunk closer to ground. It is important not to entirely ringbark the trunk, as this will decrease the uptake of the herbicide into the plant.

Cut stump application

The plant is cut off completely at its base (no higher than 15 cm from the ground) using a chainsaw, axe, brush cutter or machete (depending on the thickness of the stem/trunk). A herbicide solution is then sprayed or painted onto the exposed surface of the cut stump emerging from the ground, with the objective of killing the stump and the root system.

The herbicide solution must be applied as soon as the trunk or stem is cut. Two operators working as a team can use this method effectively. The herbicide can be applied from a knapsack, or with a paint brush, drench gun or a hand-spray bottle. It is a good idea to use a brightly coloured dye in the solution to mark the stumps that have been treated.

For trees with large circumferences, it is only necessary to place the solution around the edge of the stump (as the objective is again to target the cambium layer inside the bark). The stump circumference should be bruised with the back of an axe and each successive blow treated with herbicide.

This method has the appeal of removing the weed immediately, and is used mainly for trees and woody weeds. This method is also referred to as cut and spray or cut and paint.

Records

The Pesticide Application Record (overleaf) should be used to record use of chemicals for weed control.

Monitoring

Once initial infestations are removed, regular (annual) monitoring of the site for regrowth from root fragments or germinating seedlings should be carried out.

Pesticide Application Record



Management System Form

Project:

Start Date and Time:

Finish Date and Time:

GENERAL

Pest or problem treated (e.g. controlling of spot weed infestation):

Pesticide applied by (full name):

Operator contact address:

Operator contact phone:

Land owner/occupier (full name):

Contact address:

Contact phone:

Area(s) treated:

Order of treatment (preferably with reference to a map):

Total area of application (in m² or hectares):

PESTICIDE DETAILS

Product Used (record the full name)

Application equipment (e.g. boomspray, hand-held backpack sprayer etc):

Total amount of concentrated pesticide product used:

Total amount of diluted pesticide product mix used:

Rate of dilution:

WEATHER DETAILS (note any changes during application)

Estimate of wind speed:

Wind Direction:

Temperature:

Humidity:

NOTE: Avoid applying pesticides:

- On hot days when plants are stressed.
- After seed has set.
- Within 24 hours of rain or when rain is forecast/imminent.
- When winds will cause drift of pesticides into non-target areas.

APPENDIX 5: Unexpected EEC/Threatened Species Procedure

The unexpected EEC/threatened species procedure details the actions to be taken when a threatened flora or fauna species or EEC is unexpectedly encountered on site.

Induction/Training

All site personnel are to be inducted on the potential threatened species occurring on site and the unexpected threatened species finds procedure. Fact sheets including photos and descriptions of threatened species that construction personnel should keep watch for during earth works are included.

Threatened flora or fauna species or EEC unexpectedly encountered

STOP WORK

Notify the environment manager

Environmental Manager would arrange for an ecologist to conduct an assessment of significance of the likely impact, develop management options and notify OEH, DPI and DoE, as required.

Is an impact likely to occur?

YES

NO

Consult with OEH, DPI or DoE as appropriate

Obtain approvals, licences or permits as required

Recommence works once advice is sought and necessary approvals, licences and permits are obtained

Recommence work and maintain regular inspections

Include species in subsequent inductions, toolbox talks and update the CFFMP

APPENDIX 6: Ecological Monitoring Program

Note: ISJV have instructed its Ecological Monitoring Program Provider to advise of the need for nocturnal monitoring, or otherwise, and will include a statement as to the need for future monitoring in future Ecological Monitoring Annual Reports

North West Rail Link - Surface and Viaducts
Civil Works:
Ecological Monitoring Program

Prepared for Salini Impregilo

17 July 2015

Biosis offices

AUSTRALIAN CAPITAL TERRITORY

Canberra

Floor 1, Unit 3, 38 Essington Street
Mitchell ACT 2911

Phone: (02) 6241 2333
Fax: (03) 9646 9242
Email: canberra@biosis.com.au

NEW SOUTH WALES

Sydney

Unit 14, 17-27 Power Avenue
Alexandria NSW 2015

Phone: (02) 9690 2777
Fax: (02) 9690 2577
Email: sydney@biosis.com.au

Wollongong

8 Tate Street
Wollongong NSW 2500

Phone: (02) 4229 5222
Fax: (02) 4229 5500
Email: wollongong@biosis.com.au

QUEENSLAND

Brisbane

Suite 4 First Floor, 72 Wickham Street
Fortitude Valley QLD 4006

Phone: (07) 3831 7400
Fax: (07) 3831 7411
Email: brisbane@biosis.com.au

VICTORIA

Ballarat

506 Macarthur Street
Ballarat VIC 3350

Phone: (03) 5331 7000
Fax: (03) 5331 7033
Email: ballarat@biosis.com.au

Melbourne (Head Office)

38 Bertie Street
Port Melbourne VIC 3207

Phone: (03) 9646 9499
Fax: (03) 9646 9242
Email: melbourne@biosis.com.au

Wangaratta

16 Templeton Street
Wangaratta VIC 3677

Phone: (03) 5721 9453
Fax: (03) 5721 9454
Email: wangaratta@biosis.com.au

Document information

Report to: Salini Impregilo
Prepared by: Kylie Reed and Clare McCutcheon
Biosis project no.: 17941
File name: Appendix 6_Ecological Monitoring Program.FIN04.20150717.docx

Citation: Biosis (2014). North West Rail Link – Surface and Viaducts Civil Works: Ecological Monitoring Program. Report for Salini Impregilo. Authors: K.Reed & C.McCutcheon, Biosis Pty Ltd, Sydney. Project no. 17941

Document control

Version	Internal reviewer	Date issued
Draft version 01	Jane Murray	30/04/2014
Final version 01	Jane Murray	19/06/2014
Final Version 02	Jane Murray	22/07/2014
Final Version 03	Jane Murray	06/08/2014
Final Version 04	Jane Murray	17/07/2015

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Salini Impregilo: Steve Fermio, Tracey Austin, Neville Hattingh and Paul Bensley
- WSP: Mapping

© Biosis Pty Ltd

This document is and shall remain the property of Biosis Pty Ltd. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of the Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Disclaimer:

Biosis Pty Ltd has completed this assessment in accordance with the relevant federal, state and local legislation and current industry best practice. The company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report content or for any purpose other than that for which it was intended.

Contents

1. Introduction	3
1.1 Project background	3
1.2 Objectives and scope	3
1.3 Project area	4
2. Baseline surveys	5
2.1 Pre-clearing procedures	5
2.2 Nest-box installation.....	5
2.3 Weed and pathogen monitoring.....	6
2.4 Unexpected threatened species finds	6
2.5 Revegetation monitoring.....	7
3. Monitoring Methodology.....	8
3.1 Performance parameters	8
3.2 Monitoring actions.....	9
3.3 Timing.....	12
4. Contingency Measures and Adaptive Management	13
References.....	15

List of Tables

Table 1: Monitoring actions: reporting requirements, performance parameters and assessment criteria	9
Table 2: Timing of monitoring program.....	12
Table 3: Summary of recommended contingency measures	13

1. Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by Salini Impregilo to prepare an Ecological Monitoring Program for the North West Rail Link Surface and Viaducts Civil (SVC) works (the project). This Ecological Monitoring Program has been developed to outline specific measures to be undertaken to monitor the effectiveness of prescribed mitigation measures outlined in the Construction Flora and Fauna Management Plan (CFFMP) (Salini Impregilo 2014). This program has been developed in consultation with NSW Office of Environment and Heritage (OEH) as well as The Hills Shire Council and Blacktown Council (consultation records can be found in Appendix 8 of the CFFMP).

The North West Rail Link (NWRL) comprises a new electrified passenger line, extending the rail network in north-west Sydney from Chatswood to Tallawong Road, Rouse Hill. It will include the construction of a two-track railway corridor 23 kilometre (km) in length. The SVC component includes a 4 kilometer A 4.6 km above-ground section of line from Bella Vista to Tallawong Stabling Facility, Rouse Hill, which would be a combination of viaduct, embankment, at grade and cutting.

The project was approved state significant infrastructure under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 25 September 2012 subject to the Minister for Planning and Infrastructure's Conditions of Approval (CoA) being met.

This Ecological Monitoring Plan forms an Appendix to the CFFMP and draws together monitoring practices recommended throughout the CFFMP (specifically Section 6 of the CFFMP), associated appendices and the Urban Design and Corridor Landscape Plan. This Ecological Monitoring Plan has been prepared and reviewed by qualified and licenced zoologists (Clare McCutcheon, Kylie Reed and Jane Murray) of Biosis. The following list of appendices have been drawn upon and referred to within this document:

- Appendix 1: Sensitive Area Maps
- Appendix 2: Fauna Handling And Rescue Procedure
- Appendix 3: Vegetation Pre-Clearing Procedure
- Appendix 4: Weed Management Procedure
- Appendix 5: Unexpected Endangered Ecological Communities/Threatened Species Procedure
- Appendix 7: Nest Box Plan

1.2 Objectives and scope

The broad objective of the Ecological Monitoring Program, as stated in the CoA, is to monitor the effectiveness of mitigation measures identified in Condition C1. These mitigation measures are listed in Section 6 of the CFFMP (Salini Impregilo 2014) and are addressed in Table 3 of Section 3 herein.

The scope of this Ecological Monitoring Program is prescribed within Condition C1 of the CoA, stating that:

An Ecological Monitoring Program shall be developed to monitor the effectiveness of the biodiversity mitigation measures implemented as part of construction of the SSL. The Program shall be developed by a suitably qualified and experienced ecologist in consultation with OEH and relevant Councils and shall include, but not necessarily be limited to:

- (a) an adaptive monitoring program to assess the effectiveness of the mitigation measures. The monitoring program shall nominate performance parameters and criteria against which effectiveness of the mitigation measures will be measured;*
- (b) mechanisms for developing additional monitoring protocols to assess the effectiveness of any additional mitigation measures implemented to address additional impacts in the case of design amendments or unexpected threatened species finds during construction (where these additional impacts are generally consistent with the biodiversity impacts identified for the SSI);*
- (c) provision for the assessment of the data to identify changes to habitat usage and whether this can be directly attributed to construction of the SSI;*
- (d) details of contingency measures that would be implemented in the event of changes to habitat usage patterns directly attributable to the construction of the SSI; and*
- (e) provision for annual reporting of monitoring results to the Director General, OEH and relevant Councils, or as otherwise agreed by those agencies.*

Monitoring shall be undertaken during construction and until such time as the effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods, unless otherwise agreed by the Director General. The monitoring period may be reduced with the agreement of the Director General in consultation with OEH and relevant Councils depending on the outcomes of the monitoring.

The Program shall be submitted to the Director General for approval no later than one month prior to the commencement of construction that would result in the disturbance of ecological communities, unless otherwise agreed by the Director General.

To address the above object/scope Biosis have undertaken the following:

- Completion of a field survey which incorporated a detailed assessment of the vegetation and fauna habitat proposed to be removed, April 2014.
- Preparation of this report, which outlines monitoring requirements, responsibilities and timing.

1.3 Project area

The project area includes the extent of land proposed to be cleared or otherwise disturbed by the construction of a new rail alignment, as well as specified areas for storage, lay-down of materials or site offices and facilities.

The Ecological Monitoring Program specifically applies to those areas of the project where mitigation measures are to be implemented.

2. Baseline surveys

Section 6 of the CFFMP details the mitigation measures to be implemented for the project. The following provides a brief summary of tasks undertaken in the baseline (pre-clearing stage) to inform those measures of the Ecological Monitoring Program.

2.1 Pre-clearing procedures

Appendix 2 and Appendix 3 of the CFFMP details the fauna handling and rescue procedure and vegetation pre-clearing procedure respectively. In summary, a pre-clearance survey was undertaken to document the actual extent of native vegetation loss and fauna habitat trees to be removed.

Where native vegetation is to be retained adjacent to or within construction sites, protective fencing and signage would be installed immediately prior to vegetation clearance in accordance with *Australian Standard 4970 – 2009 Protection of Tree*. In addition to fencing area to be marked with:

- Flagging tape (red - individual trees to be retained, if possible, close to and/or adjoining the construction zone (yellow – habitat trees to be cleared).
- Signage – indicates areas or trees to be protected.

The extent of ecologically sensitive areas located adjacent to the works areas will be shown on relevant Sensitive Site Maps and physically delineated on site using protective fencing and signposting. Protective fencing and signposting will be maintained and replaced as required throughout construction. Signs indicating the area is a "SENSITIVE ENVIRONMENTAL AREA" will be clearly and securely affixed to the fencing.

The Ecologically sensitive areas include:

- Threatened species as per Eco Logical Australia 2012 Report.
- Critically Endangered Ecological Community's of Cumberland Plain Woodland and River-flat Eucalypt Forest.
- Riparian Areas (or Groundwater Dependent Ecosystems).

These areas identified as have been mapped in Appendix 1 of the CFFMP and vegetation protection and management procedures have been outlined in Section 6 of the CFFMP.

Monitoring will be undertaken to ensure these areas are retained will form the basis of the monitoring of *predicted and actual* vegetation removal.

2.2 Nest-box installation

A Nest Box Plan for the project has been developed as Appendix 7 to the CFFMP to outline specific measures to be undertaken to offset the impacts of vegetation clearance required for the project on native hollow-dependent fauna. For additional detail on the scope of the project to which this Nest Box Plan applies, refer to the Construction Flora and Fauna Management Plan (CFFMP) (Salini Impregilo 2014).

As part of the Nest Box Plan, tree hollows within the project area have been located and catalogued to outline specific measures to be undertaken to offset the impacts of vegetation clearance on native hollow-dependant fauna.

Of the 65 hollow-bearing trees identified within the project area Salini Impregilo has refined the design so to avoid vegetation clearance to result in the retention of a large number (33) of hollow-bearing trees, causing a reduction in the number of nest boxes required as offsets for vegetation clearance.

Nest box installation is recommended for all tree hollows that will be lost as a result of vegetation clearance within the project area. The requirements for the installation of nest boxes defined within the Nest Box Plan are to be adhered to. The following two requirements relate to the timing of monitoring:

- At least half of the required nest boxes will be installed prior to commencement of vegetation clearance. This will ensure that fauna which must be relocated during clearance have somewhere to be relocated to, whilst also allowing flexibility as to the final numbers of nest boxes required (based on the number of hollows which are able to be relocated).
- Any further nest boxes which are required will be ordered and installed within one month of the completion of vegetation clearance.

2.3 Weed and pathogen monitoring

Most of the study area has moderate to high levels of weed invasion due to disturbance from stormwater, vegetation clearance, and edge effects. The Weed Management Procedure (Appendix 4) identifies all record keeping requirements associated with the use of herbicides and pesticides.

In summary, to prevent establishment or spread of weeds:

- Machinery will be cleaned before entering work sites.
- Noxious weeds will be removed from within the construction boundary.
- Cleared weed material will be disposed of at a site licensed to receive green waste. This will be recorded in MSR22W-1 Waste Register in accordance with MSP22W Waste Management.
- Where pesticide is used to control noxious weeds it will be in accordance with Appendix 4.

Weeds to be controlled as required in areas affected by construction in a staged manner and for a minimum period of two years following construction works.

2.4 Unexpected threatened species finds

The ecological assessment undertaken as part of the EIS prepared by Eco Logical Australia (2012) indicated that no threatened flora is likely to occur within the project area; however there is the potential for 23 species of threatened fauna to occur.

The project area supports mapped Green and Golden Bell Frog *Litoria aurea* habitat. Presence/absence surveys were therefore undertaken for Green and Golden Bell Frog in Spring/Summer 2014, following adequate rainfall and high temperatures as per OEH and Commonwealth Department of Environment relevant guidelines. This species was not detected during targeted surveys, and given the absence of records combined with targeted surveys it can be assumed that the Green and Golden Bell Frog is unlikely to occur within the project area. Works can therefore commence without the need for further surveys and consultation with OEH regarding the Green and Golden Bell Frog.

The EIS indicates that 22 additional threatened fauna species are known or have potential to occur in the locality of the project area. Although the occurrence of these species is unlikely, any threatened fauna encountered during clearing and construction for the Project should be reported and the *Unexpected*

EEC/Threatened Species Procedure (Appendix 5 of the CFFMP) to be followed. Works should cease until advice has been provided by the Environmental Manager via the Project Ecologist that work can re-commence.

2.5 Revegetation monitoring

Mitigation measures relating to the project areas revegetation and rehabilitation, including waterways will be documented in Urban Design and Corridor Landscape Plan prepared in accordance with measure FF51 of the CFFMP.

Revegetation efforts to be monitored by an Ecologist (Botanist), annually up to 5 years after the initial revegetation (during construction).

3. Monitoring Methodology

3.1 Performance parameters

Performance parameters have been selected to provide criteria against which effectiveness of the mitigation measures will be measured. Information collected during baseline data (as described in Section 2) will be compared with that recorded during the monitoring program to quantitatively identify changes to habitat usage and whether this can be directly attributed to construction.

Performance measures will be discussed in annual reporting of monitoring results to the Director General, OEH and relevant Councils, or as otherwise agreed by those agencies.

3.2 Monitoring actions

The following table identifies actions to monitor the effectiveness of the biodiversity mitigation measures implemented as part of project. This addresses the requirement of Condition C1, items (a), (c) and (e) of the CoA.

Table 1: Monitoring actions: reporting requirements, performance parameters and assessment criteria

Refer to	Action	Description	Timing of action	Reporting	Responsibility	Performance Parameters / Assessment Criteria
Clearing procedure Monitoring						
Appendix 1, 2, 3 & 5	Removal of hollow-bearing trees	<p>Hollow-bearing trees are to be removed under the supervision of a suitably qualified ecologist by felling and not with the use of an excavator. Each hollow-bearing tree will be carefully lowered to the ground and immediately inspected by an ecologist for fauna.</p> <p>The Environment Manager (or appointed ecologist) is to supervise the removal of key fauna habitats and relocate any healthy resident native fauna to adjacent habitat and to transfer any injured fauna to a wildlife carer.</p>	During clearing operations, specifically at least 24 hours after the removal of non-habitat trees.	<p>Pre-clearing survey techniques, timing and responsibilities for surveying in accordance with Appendix 2 of the CFFMP and are to be submitted in annual reporting to the Director General, OEH and relevant Councils, or as otherwise agreed by those agencies shortly after the clearing operations have been completed. The reports will include:</p> <ul style="list-style-type: none"> • Survey date. • Time. • Surveyors. • Weather conditions. • Details of methods used during pre-clearing surveys and clearing operations. • Utilisation of the nest boxes by pest and native species. • Fauna species displaced by clearing, species, captured, species released and any wildlife • Mortalities resulting either directly or indirectly from the clearing operations. • Location of fauna within clearing footprint (recorded with GPS) and release locations. • Hollow-bearing tree register, and comparison of this data to nest box plan (assess the • Adequacy of nest boxes installed and how they are mitigating the loss of tree hollows). • Discussion of the effectiveness of those methods employed. <p>Recommendations for future pre-clearing and/or clearing procedures.</p>	Environment Manager/ Appointed ecologist	<p>The performance of removal of hollow-bearing trees procedures will be assessed against:</p> <ul style="list-style-type: none"> • Low rates of fauna injury and mortality resulting from clearing operations, particularly of threatened species. • Successful capture and release of fauna displaced by clearing operations. • Rapid processing, treatment and release of injured fauna. • Accurate quantification of fauna habitat features and hollow-bearing trees being removed. • Data collation and reporting of these measures. <p>Assessment criteria:</p> <ul style="list-style-type: none"> • Zero direct harm to wildlife. • Incidental harm to be managed/reported on by Ecologist/Environment Manager. • Incidents to be raised through toolbox meetings with all construction workers.
Appendix 1, 2, 3 & 5	Monitoring of vegetation clearance in areas adjacent to ecologically sensitive areas or vegetation to be retained.	Pre-clearance survey was undertaken to document the actual extent of native vegetation. Following the installation of protective fencing and signage, on-going monitoring is to be undertaken to ensure no accidental clearing is undertaken in native and derived plant communities and associated habitat for threatened and non-threatened terrestrial biodiversity (demonstrates avoidance). Monitoring of 'likely' or 'potential' Groundwater Dependent Ecosystems (GDEs) would include	<p>Monitoring of vegetation clearance to be undertaken:</p> <ol style="list-style-type: none"> 1. On a weekly basis during construction by the on site environmental officer. 2. Immediately after construction by the on site 	<p>Pre-clearing survey techniques, timing and responsibilities for surveying are detailed in Section 6 of the CFFMP. The following documentation is to be kept on record following each monitoring event and is to be submitted in annual reporting to the Director General, OEH and relevant Councils, or as otherwise agreed by those agencies shortly after the clearing operations have been completed:</p> <ul style="list-style-type: none"> • Survey date. • Time. • Surveyors. • Location and extent of vegetation clearance, including photo-point monitoring. 	Environment Manager/ Appointed ecologist	<p>The performance of pre-clearing and clearing procedures will be assessed against:</p> <ul style="list-style-type: none"> • Successful removal of intended vegetation without accidental damage to vegetation proposed for retention. • No change in GDE water quality and levels. • Data collation and reporting of these measures. <p>Assessment criteria:</p> <ul style="list-style-type: none"> • Zero impact to vegetation marked for

Refer to	Action	Description	Timing of action	Reporting	Responsibility	Performance Parameters / Assessment Criteria
		<p>monitoring of water quality and levels. A register of sensitive site maps will be maintained.</p> <p>A final post construction assessment is to be undertaken to determine any off site impacts to retained vegetation.</p>	environmental officer.	<ul style="list-style-type: none"> Location and photographs of protective fencing and signage. Discussion of the effectiveness of those methods employed. If there is any deterioration or damage to protective fencing and signage and if maintenance is required. 		<p>protection</p> <ul style="list-style-type: none"> Groundwater and water quality levels to conform with Project Approval parameters/requirements. Reporting regarding vegetation clearance and groundwater/water quality to be prepared and provided to relevant stakeholders as per Project Approval parameters/requirements.
Nest Box Monitoring						
Appendix 7	Monitoring of nest boxes	A visual inspection of each nest box will be undertaken by an appropriately trained zoologist using a ground-based nest-box surveillance camera or in conjunction with a qualified arborist if tree climbing is required.	<p>Monitoring of nest boxes to be undertaken:</p> <ol style="list-style-type: none"> During construction Immediately after construction At least 6 months to a year after construction, preferably in summer and for each year up to five years. 	<p>Brief monitoring reports are to be produced following each nest box monitoring session, as outlined in Biosis (2015), and these are to be submitted in annual reporting to the Director General, OEH and relevant Councils, or as otherwise agreed by those agencies shortly after the clearing operations have been completed. The following information will be collected for each nest box:</p> <ul style="list-style-type: none"> Nest box Identification number. Time each nest box was inspected. Inspection date, weather conditions (precipitation, cloud cover, temperature) If the nest box is occupied by native fauna, and if so, the species. If the nest box is not occupied by a native species, record any signs of use by native species such as feathers, droppings, scats, hair or nesting material. If the nest box is occupied by a pest species such as European bees, or common myna. Is there any deterioration of the nest box and is any maintenance required. Any changes to the surrounding habitats, such as clearing. 	Environment Manager/ Appointed ecologist	<p>Indicators of success of nest boxes include:</p> <ul style="list-style-type: none"> Use of nest boxes by a wide range of native fauna species. Use of nest boxes designed for specific species by those same species <p>Assessment criteria:</p> <ul style="list-style-type: none"> Inspection to be undertaken to record nest box utilisation (by which species, native and pest) and success yearly for five years. Reporting to outline nest box utilisation and success yearly for five years.
Appendix 7	Nest box maintenance regime	<p>The maintenance regime will involve:</p> <ul style="list-style-type: none"> The removal of pest species such as common myna, common starlings and European bees. The replacement of fallen, damaged or deteriorated nest boxes. The repositioning or relocation of nest boxes that show no sign of use after several successive monitoring periods The removal or excess nesting material that may block access to the nest box over time. 	Once every two years for a five year period upon completion of the project (operation phase).	<p>The following information will be collected for each nest box and is to be submitted in annual reporting to the Director General, OEH and relevant Councils, or as otherwise agreed by those agencies shortly after the clearing operations have been completed:</p> <ul style="list-style-type: none"> Nest box Identification number. Time each nest box was inspected. Inspection date, weather conditions (precipitation, cloud cover, temperature). If the nest box is occupied by a pest species such as European bees, or common myna. Maintenance completed. 	Environment Manager	<p>Indicators of success of nest boxes include:</p> <ul style="list-style-type: none"> Use of nest boxes designed for specific species by those same species. Low rate of use of nest boxes by pest species Low level of maintenance of nest boxes. <p>Assessment criteria:</p> <ul style="list-style-type: none"> >60% uptake of nest boxes by native species. <20% uptake of nest boxes by pest species. <5% of nest boxes requiring maintenance over a five year span.
Weed and Pathogen Monitoring						

Refer to	Action	Description	Timing of action	Reporting	Responsibility	Performance Parameters / Assessment Criteria
Appendix 4	Mapping of Noxious Weeds and Pathogens	Noxious weed mapping will occur progressively throughout construction prior to clearing works in each location. Weed management will occur throughout the extent and duration of the project in accordance with WI22T-6 Weed Control.	Noxious weed management to be undertaken: 1. Prior construction 2. During construction 3. For a period of two years following construction works.	Weed Management Procedure (Appendix 4) identifies all record keeping requirements associated with the use of herbicides and pesticides.	Environment Manager	Indicators of success of the Weed Management Procedure include: <ul style="list-style-type: none"> No new noxious weed and pathogen infestations within the project area and in adjacent bushland as a result of the project. A reduction in the area of noxious weed and pathogen infestations within the project area. Assessment criteria: <ul style="list-style-type: none"> No new noxious weed species (in addition to EIS species list) to establish in the SVC corridor. A 50% reduction in EIS identified weed infestations to be achieved in year 1, with gradual improvement for the following two years.
Revegetation Monitoring						
Urban Design and Corridor Landscape Plan	Revegetation and rehabilitation measures	Specific rehabilitation measures for each watercourse will be documented in Urban Design and Corridor Landscape Plan.	<i>Refer to Urban Design and Corridor Landscape Plan</i>			

3.3 Timing

As a requirement of Condition C1 of the CoA, monitoring is to be undertaken during construction and until such time as the effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods, unless otherwise agreed by the Director General. In addition, monitoring is to be undertaken by a suitably qualified and licenced ecologist.

Monitoring success/failure will be based on the EIS as a baseline as well as prior undertaken pre-clearance surveys.

Table 2: Timing of monitoring program

Action	Construction Phase	Operation Phase					Seasonal Requirements
		Year 1 - post-construction	Year 2	Year 3	Year 4	Year 5	
Supervision of fauna habitat clearance	Once						N/A
Removal of hollow-bearing trees	Once						Autumn/Winter
Monitoring of vegetation clearance	Weekly	Once					Spring/Summer
Monitoring of nest boxes		Once	Once	Once	Once	Once	Spring/Summer
Nest box maintenance regime		Biennial		Biennial		Biennial	During monitoring
Weed and Pathogen Monitoring	Weekly	Monthly	Monthly				Spring/Summer
Green and Golden Bell Frog Habitat Monitoring	Weekly	Once					Spring/Summer
Revegetation Monitoring	Spring/Summer						
Annual reporting to Director General, OEH and relevant Councils, or as otherwise agreed	Annual	Annual	Annual	Annual	Annual	Annual	Project timeframe specific

4. Contingency Measures and Adaptive Management

The following section summarises the potential problems that may arise and the recommended contingency measures. This addresses the requirement of Condition C1, items (a), (b) and (d) of the CoA.

Appendix 5 of the CFFMP details the procedure if unexpected threatened species are identified during construction or following pre-clearing surveys. In summary, works in the immediate vicinity will be ceased until an appropriate assessment of impacts and mitigation methods is completed. This will include consultation with Department of Primary Industries (DPI) and NSW Environment and Heritage. Management measures will include (as a minimum) relocation and the updating of the Ecological Monitoring Program and/or Transport for NSW implementing additional biodiversity offset requirements.

Table 3: Summary of recommended contingency measures

Action	Potential Problem	Contingency Measure
Clearing Procedures	<ul style="list-style-type: none"> Previously undetected threatened fauna is located 	<ul style="list-style-type: none"> Follow the <i>Unexpected EEC/Threatened Species Procedure</i> (Appendix 5, CFFMP). Notify Environmental Manager and relevant authorities. . Project ecologist to record location of species with GPS. Project ecologist to relocate and release fauna into suitable adjoining habitat. Seek approval from relevant authorities to relocate threatened species if required.
	<ul style="list-style-type: none"> Previously undetected threatened flora species is located 	<ul style="list-style-type: none"> Follow the <i>Unexpected EEC/Threatened Species Procedure</i> (Appendix 5, CFFMP). Notify Environmental Manager and relevant authorities. Project ecologist to record location of species with GPS. Delineate threatened species with highly visible tape to protect it from clearing. Seek approval from relevant authorities to translocate species if required.
	<ul style="list-style-type: none"> Identification of previously undocumented EEC 	<ul style="list-style-type: none"> Follow the <i>Unexpected EEC/Threatened Species Procedure</i> (Appendix 5, CFFMP). Notify Environmental Manager and relevant authorities.. Project ecologist to delineate boundaries of the EEC with a GPS and highly visible tape. Consult with relevant authorities for management of additional EEC.

Action	Potential Problem	Contingency Measure
	<ul style="list-style-type: none"> • High rates of fauna injury and mortality resulting from clearing operations • Low rates of capture and relocation of displaced fauna 	<ul style="list-style-type: none"> • Review clearing procedures. • Modify habitat tree retention times and/or Stage 2 (habitat tree felling) clearing procedures. • Review approach of clearing contractor
Nest Boxes	<ul style="list-style-type: none"> • Nest box being used by non-target species • Nest boxes become occupied by exotic or invasive fauna such as European bees 	<ul style="list-style-type: none"> • Review number and design of nest boxes • Review/modify nest box design to exclude undesirable species, treat nest boxes to deter/eradicate pest species, or relocated nest boxes once each year for the five year monitoring period.
Revegetation	<ul style="list-style-type: none"> • In appropriate species selection • Poor survival rates of revegetated plantings 	<ul style="list-style-type: none"> • Revegetation efforts to be monitored by an Ecologist (Botanist), annually up to 5 years after the initial revegetation (during construction). • An annual monitoring report to be prepared to outline revegetation success' and failures and recommendations.

References

Biosis (2015). North West Rail Link – Surface and Viaducts Civil Works: Nest Box Plan. Report for Salini Impregilo. Authors: C. McCutcheon, Biosis Pty Ltd, Sydney. Project no. 17941.

Eco Logical Australia (2012). Ecological Assessment for the North West Rail Link. Prepared for Transport for NSW.

Salini Impregilo (2014). North West Rail Link – Surface and Viaducts Civil (SVC) Works - Construction Flora and Fauna Management Plan. Draft report.

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



APPENDIX 7: Nest Box Plan

North West Rail Link - Surface and Viaducts
Civil Works:
Nest Box Plan

Prepared for Salini Impregilo
17 July 2015

Biosis offices

AUSTRALIAN CAPITAL TERRITORY

Canberra

Floor 1, Unit 3, 38 Essington Street
Mitchell ACT 2911

Phone: (02) 6241 2333
Fax: (03) 9646 9242
Email: canberra@biosis.com.au

NEW SOUTH WALES

Sydney

Unit 14, 17-27 Power Avenue
Alexandria NSW 2015

Phone: (02) 9690 2777
Fax: (02) 9690 2577
Email: sydney@biosis.com.au

Wollongong

8 Tate Street
Wollongong NSW 2500

Phone: (02) 4229 5222
Fax: (02) 4229 5500
Email: wollongong@biosis.com.au

QUEENSLAND

Brisbane

Suite 4 First Floor, 72 Wickham Street
Fortitude Valley QLD 4006

Phone: (07) 3831 7400
Fax: (07) 3831 7411
Email: brisbane@biosis.com.au

VICTORIA

Ballarat

506 Macarthur Street
Ballarat VIC 3350

Phone: (03) 5331 7000
Fax: (03) 5331 7033
Email: ballarat@biosis.com.au

Melbourne (Head Office)

38 Bertie Street
Port Melbourne VIC 3207

Phone: (03) 9646 9499
Fax: (03) 9646 9242
Email: melbourne@biosis.com.au

Wangaratta

16 Templeton Street
Wangaratta VIC 3677

Phone: (03) 5721 9453
Fax: (03) 5721 9454
Email: wangaratta@biosis.com.au

Document information

Report to: Salini Impregilo
Prepared by: Clare McCutcheon, Carl Corden
Biosis project no.: 17941
File name: Appendix 7_NestBoxPlan.FIN04.20150717.docx

Citation: Biosis (2015). North West Rail Link – Surface and Viaducts Civil Works: Nest Box Plan. Report for Salini Impregilo. Authors: C. McCutcheon, C. Corden Biosis Pty Ltd, Sydney. Project no. 17941

Document control

Version	Internal reviewer	Date issued
Draft version 01	Kylie Reed	30/04/2014
Final version 01	Jane Murray	19/04/2014
Final version 02	Jane Murray	22/07/2014
Final version 03	Jane Murray	06/08/2014
Final version 04	Jane Murray	17/07/2014

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Salini Impregilo: Steve Fermio, Paul Bensley and Tracey Austin
- WSP Global Inc: Mapping
- Blacktown Council: Robert Blackall
- The Hills Shire Council: Mark Chidel

The following Biosis staff were involved in this project:

Jane Murray, Clare McCutcheon, Carl Corden and Kylie Reed.

© Biosis Pty Ltd

This document is and shall remain the property of Biosis Pty Ltd. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of the Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Disclaimer:

Biosis Pty Ltd has completed this assessment in accordance with the relevant federal, state and local legislation and current industry best practice. The company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report content or for any purpose other than that for which it was intended.

Contents

1. Introduction	3
1.1 Project background	3
1.2 Scope of assessment.....	3
1.3 Project area	3
2. Methods	4
2.1 Background.....	4
2.2 Field assessment.....	4
2.3 Consultation.....	5
2.4 Mapping.....	5
2.5 Limitations.....	5
3. Results	6
4. Management Actions	16
4.1 Avoidance of Hollow-bearing Trees.....	16
4.2 Hollow-bearing Tree and Fauna Management.....	16
4.3 Nest Box Installation.....	17
4.4 Monitoring and Maintenance	18
4.5 Summary and Timing of Management Actions.....	19
References.....	21
Appendices	22
Appendix 1: Tree Hollow Data	23

List of Figures

Figure 1: Location of hollow-bearing trees within the project area to be impacted.....	7
Figure 2: Hollow-bearing Tree Loss and Nest Box Offset Locations	15

List of Tables

Table 1: Suggested number of nest box types.....	17
Table 2: Summary of management actions, timing and responsibilities	20

1. Introduction

1.1 Project background

Biosis Pty Ltd (Biosis) was commissioned by Salini Impregilo to prepare a Nest Box Plan for the North West Rail Link Surface and Viaducts Civil (SVC) works (the project). This Nest Box Plan has been developed to outline specific measures to be undertaken to offset the impacts of vegetation clearance required for the project on native hollow-dependant fauna and has been developed in consultation with Blacktown Council and The Hills Shire Council. For additional detail on the scope of the project to which this Nest Box Plan applies, refer to the Construction Flora and Fauna Management Plan (CFFMP) (Salini Impregilo 2014). This Nest Box Plan forms Appendix 7 of the CFFMP.

This Nest Box Plan has been prepared to satisfy Condition E6 of the Minister for Planning and Infrastructure's Conditions of Approval (CoA) for the project:

Prior to the commencement of construction work that would result in the disturbance of native vegetation (or as otherwise agreed by the Director General) a Nest Box Plan to provide replacement hollows for displaced fauna shall be prepared in consultation with the Office of Environment and Heritage (OEH) and relevant Council(s). The Nest Box Plan, to be incorporated into the Biodiversity Offset Package (condition C5), shall detail the number and type of nest boxes to be installed, which shall be justified based on the number and type of hollows removed (based on pre-clearing surveys), the density of hollows in the area to be cleared and in adjacent areas, and the availability of adjacent food resources. The Nest Box Plan shall also consider the relocation of any hollows removed from the site to provide for potential nesting habitat. The Nest Box Plan shall also provide details of maintenance protocols for the nest boxes installed including responsibilities, timing and duration.

1.2 Scope of assessment

The primary objective of this Nest Box Plan was to locate and catalogue the tree hollows within the project area and to outline specific measures to be undertaken to offset the impacts of vegetation clearance on native hollow-dependant fauna. This has been met through:

- Completion of a field survey which incorporated a rapid ground-based assessment to identify hollow-bearing trees within the project area and to identify vegetation adjacent to the clearance area that is suitable to house the relocated hollows or substitute nest boxes.
- Preparation of this Nest Box Plan, taking into account the survey results, current design and estimated limits of clearing (i.e. the clearance area) as provided by Salini Impregilo. Where hollows cannot be relocated, this Nest Box Plan includes the types and specifications of nest boxes that will be required and where they should be installed.
- Provide suitable locations for the installation of nest boxes within close proximity to the alignment.

1.3 Project area

The project area includes the extent of land proposed to be cleared or otherwise disturbed by the construction of a new rail alignment for the North West Rail Link, as well as specified areas for storage, lay-down of materials or site offices and facilities. The removal or disturbance of hollow-bearing trees will largely be confined to the project area; however there may be indirect effects of clearance and construction on habitat immediately adjacent to the project area. Salini Impregilo has advised that there may also be opportunities to retain remnant trees within the project clearance area.

2. Methods

2.1 Background

'Loss of hollow-bearing trees' is listed as a Key Threatening Process (KTP) under Schedule 3 of the *Threatened Species Conservation Act 1995* (TSC Act) (NSW Scientific Committee 2007). Of the (at least) 46 terrestrial vertebrate species reliant on tree hollows for shelter and/or reproduction in New South Wales (NSW) (Gibbons and Lindenmayer 2002), 40 species are listed as threatened under the TSC Act. 'Removal of dead wood and dead trees' is also listed as a KTP under Schedule 3 of the TSC Act (NSW Scientific Committee 2003). This includes the removal of standing dead wood, which reduced the availability of hollows and the input of material to the litter layer.

Within the project area, hollow-bearing trees are likely to provide habitat for a range of common birds such as parrots and Laughing Kookaburra *Dacelo novaeguineae*, as well as arboreal mammal species such as the Common Brushtail Possum *Trichosurus vulpecula* and Sugar Glider *Petaurus breviceps*. They are likely to also support common Microchiropteran bats such as the Little Forest Bat *Vespadelus vulturnus* and the Chocolate Wattled Bat *Chalinolobus morio*.

The Environmental Impact Statement (EIS) undertaken for the broader North West Rail Link project identified a number of hollow-dependent threatened species that have potential to occur within the locality (Table 17, Eco Logical Australia 2012).

2.2 Field assessment

A field assessment was undertaken on 8 and 9 April 2014, to identify and assess tree hollows within the project area, as well as to identify areas adjacent to the project area which may be suitable to house nest boxes or relocated hollows. The field assessment for tree hollows took the form of a rapid ground based assessment using two experienced ecologists.

For each hollow-bearing tree recorded within the project area, the following data were collected:

- Location of tree taken using GPS (accurate +/- 3m).
- Species of tree (if living).
- Number of hollows as best estimated from the ground.
- Height and location of each hollow (branch, limb or trunk).
- Estimation of hollow size based upon volume and entrance size (small 0-5 cm, medium 5-15 cm or large >15 cm).
- Additional information such as evidence of fauna occupation or likely current occupant (i.e. parrot, glider, possum, Microchiropteran bats etc.).

2.3 Consultation

In the final stages of the next box plan development, Blacktown Council and The Hills Shire Council were consulted with regard to suitable parks and reserves in each of the Local Government Areas (LGA) that may form suitable offset areas in which nest boxes could be installed.

2.4 Mapping

Salini Impregilo supplied aerial photography and site plans, and WSP Global Inc produced all mapping outputs using a Geographic Information System (GIS).

Mapping was conducted using hand-held (uncorrected) GPS units (WGS84) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration. For this reason, hollow-bearing trees were also photographed and flagged in the field to assist with on-ground identification.

2.5 Limitations

The tree hollow field assessment was undertaken in the form of a rapid ground-based survey, with the aim of providing an estimate of the number and approximate size of tree hollows present within the project area. Due to the inability to see within tree hollows using ground-based surveys, it was not possible to confirm fauna occupation of the majority of potential hollows observed.

Despite the significant limitations of ground-based tree hollow assessments, the current assessment is considered to be sufficient in providing a realistic estimate of the number and size of tree hollows present within the project area and likely to be impacted by the proposed works.

One section of the project area located immediately north of Windsor Road (Amber Tiles property) was not accessed during the tree hollow assessment due to access restrictions. An estimated total of three hollow-bearing trees are located within this property. These trees were visually assessed from the perimeter of the property in order to obtain a conservative estimate of tree hollows present.

3. Results

The project area supports areas of known and/or potential forage, shelter and breeding habitat for a range of fauna, including a number of species listed as threatened under the EPBC Act and/or the TSC Act. Habitat to be removed for the project represents only a small portion of available habitat resources (including forage, shelter and breeding habitat for a range of fauna) within the larger project area.

A total of 65 hollow-bearing trees, supporting an estimated 317 hollows, were identified within the project area. The complete hollow dataset is provided as Appendix A and the locations of the hollow-bearing trees recorded by Biosis are shown in Figure 1.

Of the 65 hollow-bearing trees identified within the project area Salini Impregilo has refined the design so as to avoid vegetation clearance to result in the retention of a large number (33) of hollow-bearing trees, causing a reduction in the number of nest boxes required as offsets for vegetation clearance.

The remaining 32 hollow bearing trees (Figure 1) supporting an estimated 161 hollows will be removed or substantially disturbed as a consequence of the vegetation clearance for the project. The following is a breakdown of hollows per size class observed:

- Small = 95
- Medium = 54
- Large = 10
- Very Large = 2

A variety of hollow types (fissures, spouts and hollows) and sizes were recorded within the project area, however the majority of hollows were found to be small to medium-sized spouts, which are likely to support small hollow-nesting birds and microbats. Very few large hollows capable of supporting larger birds (such as owls) or large possums were observed.

Hollow height ranged from 1.5 to 30 metres above natural ground level. The majority of hollow-bearing trees identified within the project area were Narrow-leaved Ironbark *Eucalyptus crebra*. Hollows were also commonly encountered in Forest Red Gum *E. tereticornis* and in stags.

Although most hollows were too high in the tree to internally inspect during the current survey, one hollow (in Tree 56), was occupied by a pair of Rainbow Lorikeets *Trichoglossus haematodus*. Another five hollows (Trees 31, 34 and 65) had many scratch marks around the entrance or protruding nesting material, indicating past or current use.

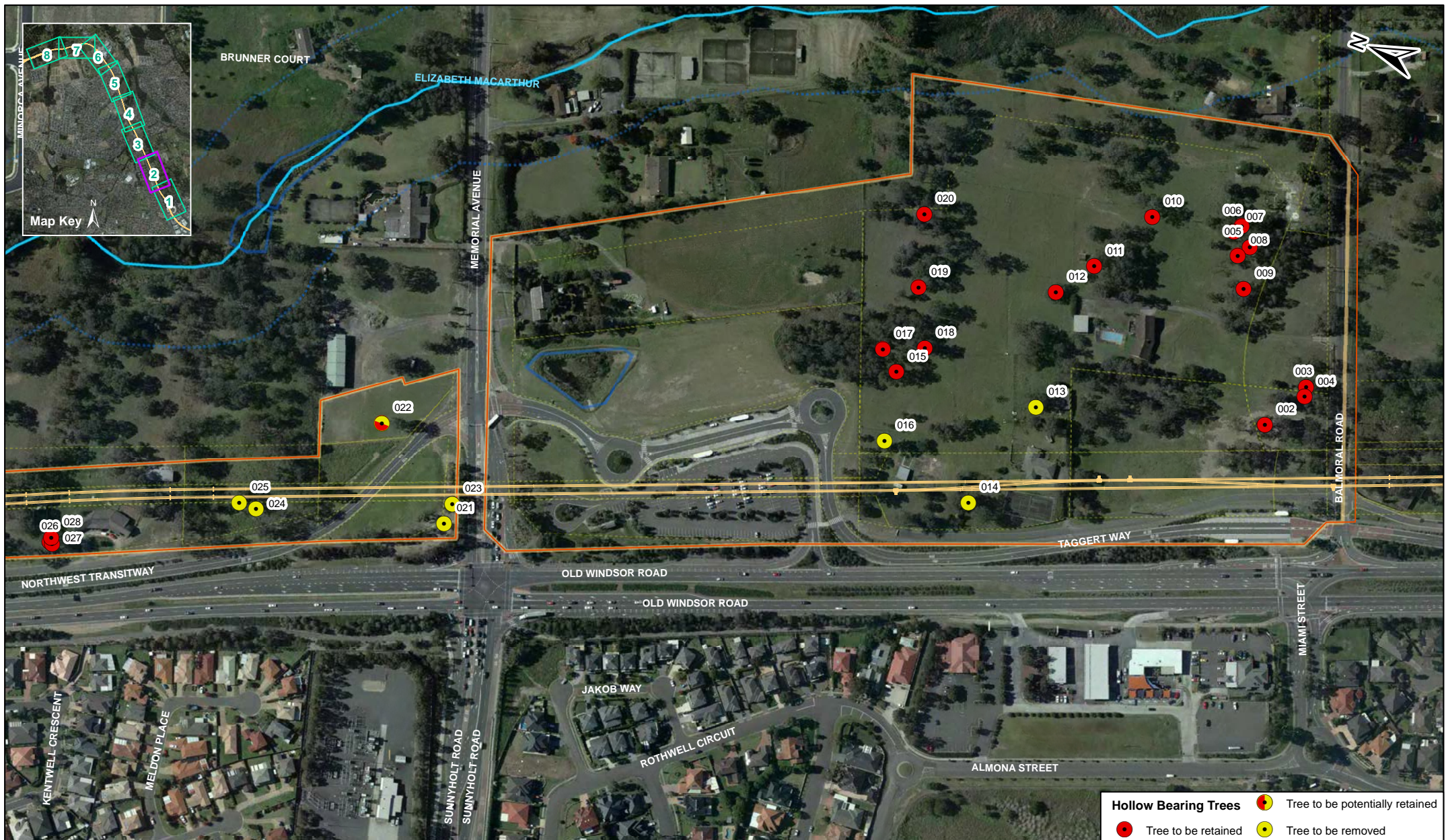
The proposed rail alignment runs adjacent to a number of small and disjunct woodland patches which would provide forage resources for hollow-dependent fauna. Some of these patches may therefore be suitable areas for hosting relocated hollows and a small number of nest boxes. Following consultation with both The Hills Shire and Blacktown Council's, each provided a range of suitable parks and reserves representing similar woodland communities. The final locations chosen include:

- The Hills Shire Council: William Harvey Reserve, Ironbark Ridge Reserve and Bruce Purser Reserve, which run parallel to the alignment (Figure 2).
- Blacktown Council: Cudgegong Reserve and Fyfe Reserve (Figure 2).

In addition to the above locations nest boxes are also proposed to be offset within and along the project boundary (Figure 2). These areas would provide suitable forage habitat for hollow-dependent fauna.

Figure 1: Location of hollow-bearing trees within the project area to be impacted




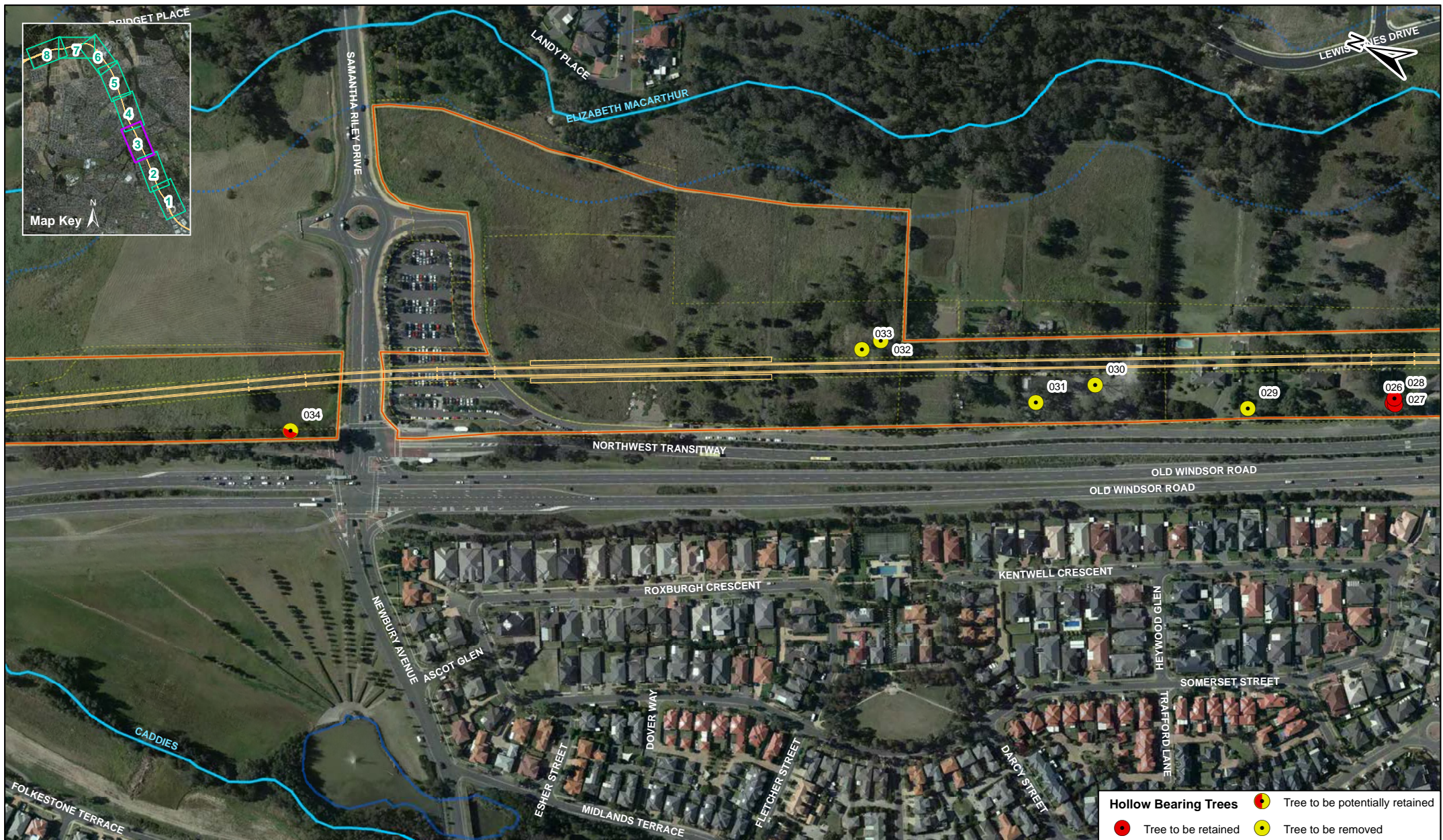


F	16/09/14	EM	Adjusted Tree Hollow colour coding as requested by WSP		
E	04/09/14	EM	Reversed Hollow Tree colour coding as requested by NWRL	JM	-
D	30/07/14	BH	Revised issue following site works	JM	-
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Legend	
Green Golden Bell Frog Habitat	Concept Alignment: EIS2Sub
Primary Habitat	Project Boundary
Secondary Habitat	Construction Boundary EIS1
River / Creek	Construction Boundary EIS2
Water body	
Riparian Buffer - Approx	

CLIENT:	Impregilo Salini Joint Venture	DESIGN DRAWN:	BH	DATE:	JULY 2014
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 9/10: Balmoral to Memorial				
TITLE:	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Hollow Bearing Trees				
SCALE: 1:2,500 @ A3		 Meters			
DRAWING No:		FIGURE 2		REV: F	
© WSP Environmental Pty Ltd					



Hollow Bearing Trees

- Tree to be retained
- Tree to be removed

F	16/09/14	EM	Adjusted Tree Hollow colour coding as requested by WSP		
E	04/09/14	EM	Reversed Hollow Tree colour coding as requested by NWRL	JM	-
D	30/07/14	BH	Revised issue following site works	JM	-
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS: DRAFT					



Legend	
 Primary Habitat	— Concept Alignment: EIS2Sub
 Secondary Habitat	 Project Boundary
— River / Creek	 Construction Boundary EIS1
 Water body	 Construction Boundary EIS2
 Riparian Buffer - Approx	

CLIENT: Impregilo Salini Joint Venture	DESIGN DRAWN: BH	DATE: JULY 2014
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 11: Kellyville	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Meters	
TITLE: Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Hollow Bearing Trees	DRAWING No: FIGURE 3	REV: F
© WSP Environmental Pty Ltd		



Hollow Bearing Trees	Tree to be retained	Tree to be potentially retained
	Tree to be removed	

F	16/09/14	EM	Adjusted Tree Hollow colour coding as requested by WSP		
E	04/09/14	EM	Reversed Hollow Tree colour coding as requested by NWRL	JM	
D	30/07/14	BH	Revised Issue following site works	JM	
C	04/06/14	BH	Revised Issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised Issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft Issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS: DRAFT					



Legend	
Green Golden Bell Frog Habitat	
Primary Habitat	Concept Alignment: EIS2Sub
Secondary Habitat	Project Boundary
River / Creek	Construction Boundary EIS1
Water body	Construction Boundary EIS2
Riparian Buffer - Approx	

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: BH	DATE: JULY 2014
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 12: SR Drv to Windsor Rd	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Meters	
TITLE: Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Hollow Bearing Trees	DRAWING No: FIGURE 4	REV: F
© WSP Environmental Pty Ltd		

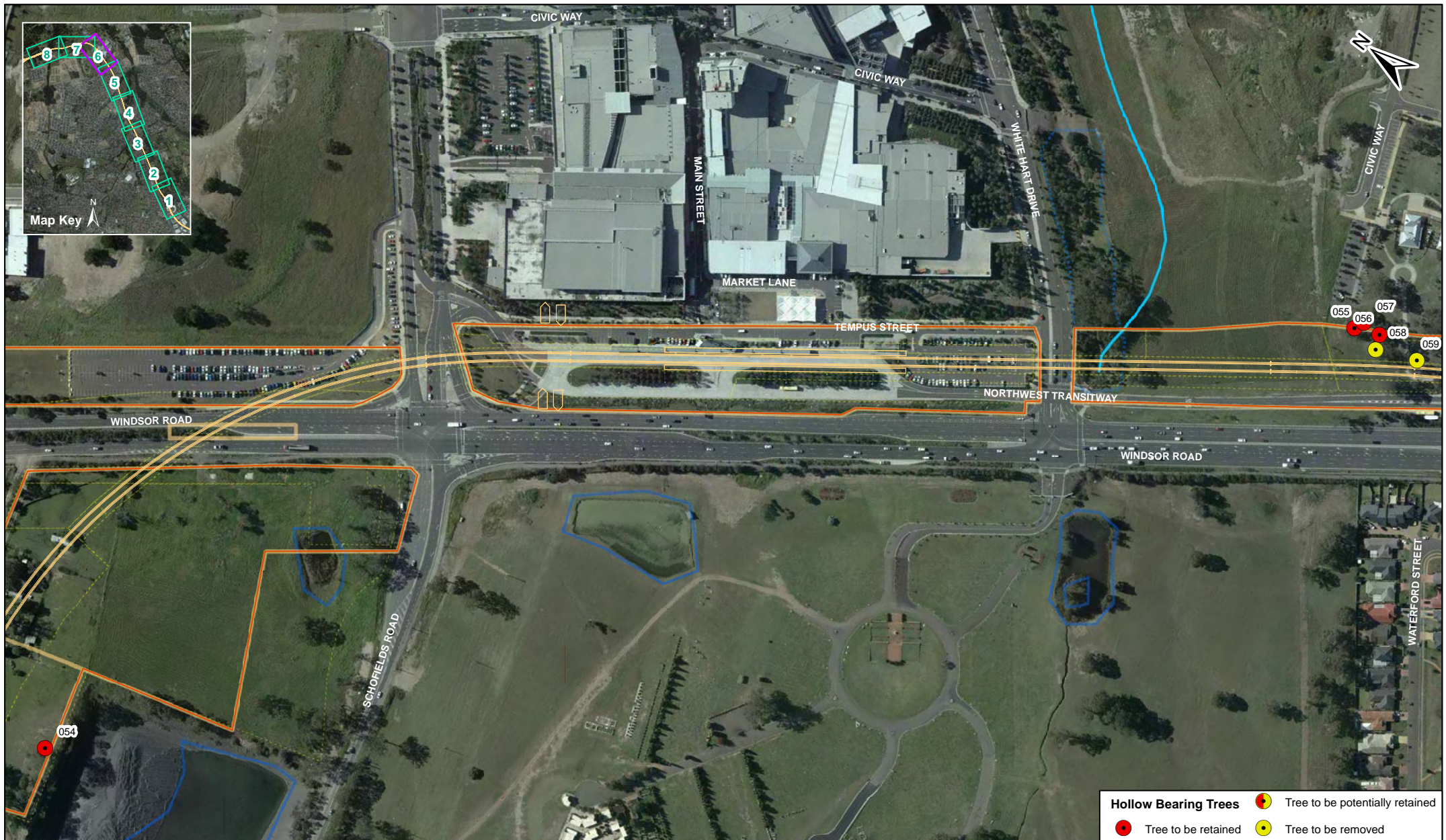


F	16/09/14	EM	Adjusted Tree Hollow colour coding as requested by WSP		
E	04/09/14	EM	Revised Hollow Tree colour coding as requested by NWRL	JM	
D	30/07/14	BH	Revised Issue following site works	JM	
C	04/06/14	BH	Revised Issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised Issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft Issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS: DRAFT					



Legend	
Green Golden Bell Frog Habitat	Concept Alignment: EIS2Sub
Primary Habitat	Project Boundary
Secondary Habitat	Construction Boundary EIS1
River / Creek	Construction Boundary EIS2
Water body	
Riparian Buffer - Approx	

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: BH	DATE: JULY 2014
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 13: Old Windsor Rd to WHD	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Meters	
TITLE: Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Hollow Bearing Trees	DRAWING No: FIGURE 5	REV: F
© WSP Environmental Pty Ltd		



F	16/09/14	EM	Adjusted Tree Hollow colour coding as requested by WSP	JM	
E	04/09/14	EM	Reversed Hollow Tree colour coding as requested by NWRL	JM	
D	30/07/14	BH	Revised Issue following site works	JM	
C	04/06/14	BH	Revised Issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised Issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft Issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS: DRAFT					



Legend	
Green Golden Bell Frog Habitat	— Concept Alignment: EIS2Sub
Primary Habitat	Project Boundary
Secondary Habitat	Construction Boundary EIS1
River / Creek	Construction Boundary EIS2
Water body	
Riparian Buffer - Approx	

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: BH	DATE: JULY 2014
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 14: Rouse Hill	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Meters	
TITLE: Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Hollow Bearing Trees	DRAWING No: FIGURE 6	REV: F
© WSP Environmental Pty Ltd		

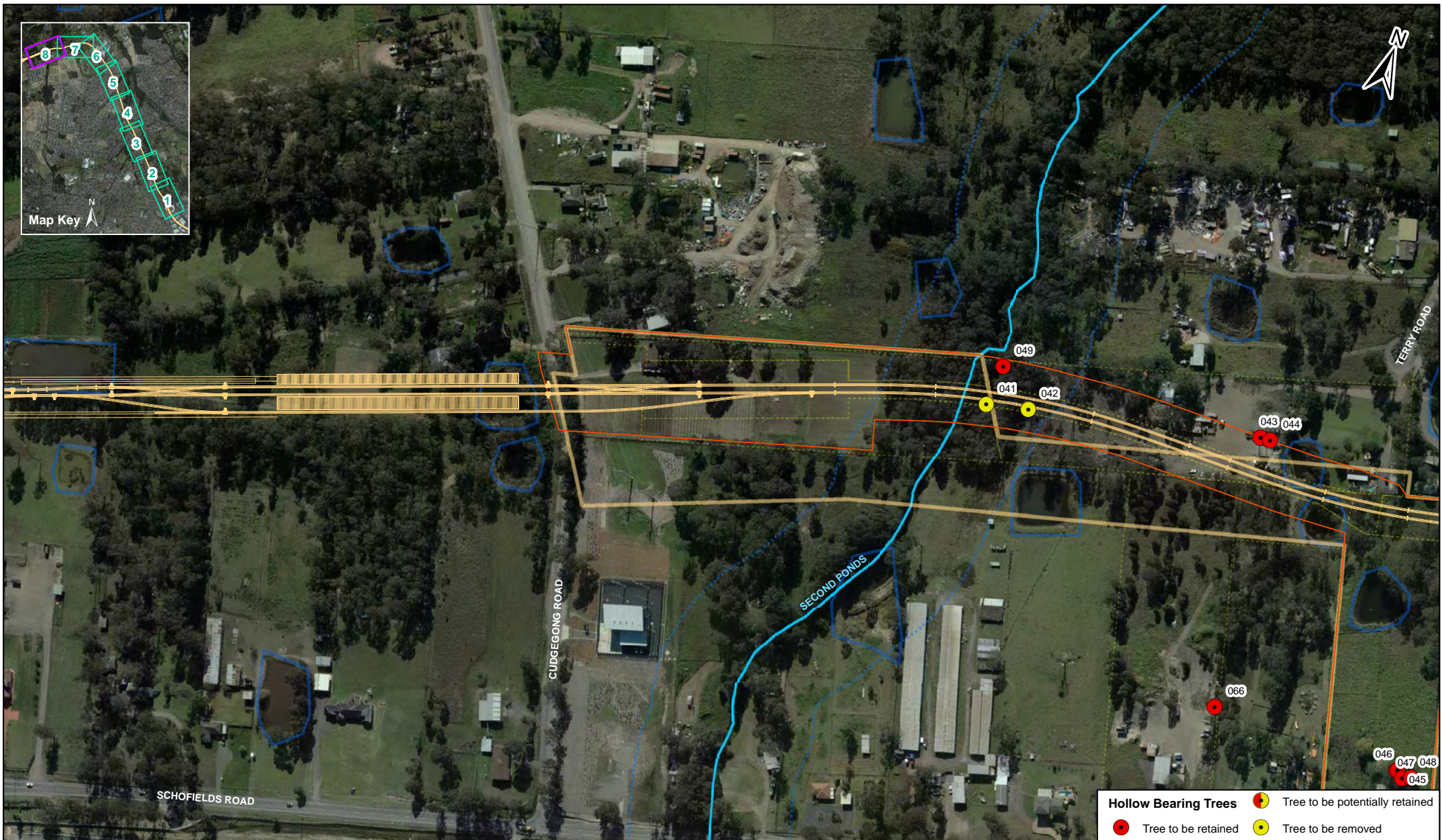


F	16/09/14	EM	Adjusted Tree Hollow colour coding as requested by WSP		
E	04/09/14	EM	Reversed Hollow Tree colour coding as requested by NWRL	JM	
D	30/07/14	BH	Revised issue following site works	JM	
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS: DRAFT					



Legend	
Green Golden Bell Frog Habitat	Concept Alignment: EIS2Sub
Primary Habitat	Project Boundary
Secondary Habitat	Construction Boundary EIS1
River / Creek	Construction Boundary EIS2
Water body	
Riparian Buffer - Approx	

CLIENT: Impregilo Salini Joint Venture	DESIGN DRAWN: BH	DATE: JULY 2014
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 15: Windsor Rd Viaduct	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Meters	
TITLE: Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Hollow Bearing Trees	DRAWING No: FIGURE 7	REV: F
© WSP Environmental Pty Ltd		



F	16/09/14	EM	Adjusted Tree Hollow colour coding as requested by WSP		
E	04/09/14	EM	Reversed Hollow Tree colour coding as requested by NWRL	JM	-
D	30/07/14	BH	Revised Issue following site works	JM	-
C	04/06/14	BH	Revised Issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised Issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft Issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS: DRAFT					



Legend	
Green Golden Bell Frog Habitat	Concept Alignment: EIS2Sub
Primary Habitat	Project Boundary
Secondary Habitat	Construction Boundary EIS1
River / Creek	Construction Boundary EIS2
Water body	
Riparian Buffer - Approx	

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: BH	DATE: JULY 2014
PROJECT: North West Rail Link Surface and Viaducts Civil Works Site 16: WR Via to Cudgegong Rd	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Meters	
TITLE: Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Hollow Bearing Trees	DRAWING No: FIGURE 8	REV: F
© WSP Environmental Pty Ltd		



A	18/07/14	BH	Original Issue	CHK	APD
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:			DRAFT		



Legend

- Hollow Bearing Tree (to be removed)
- Concept Alignment: EIS2Sub
- Construction Boundary
- Cadastral Boundary
- Blacktown LGA
- The Hills Shire LGA

Parkland Reserves

- Within The Hills LGA
- Within Blacktown LGA

CLIENT: Impregilo Salini Joint Venture	DESIGN-DRAWN: BH	DATE: JULY 2014
PROJECT: North West Rail Link Surface and Viaducts Civil Works	SCALE: 1:15,000 @ A3 Meters	
TITLE: Hollow Bearing Tree Loss and Nest Box Offset Locations	DRAWING No: FIGURE 1	REV: A
© WSP Environmental Pty Ltd		

4. Management Actions

In Australia, around 300 vertebrate species (including numerous threatened species) are known to utilise tree hollows for breeding and/or shelter (Gibbons and Lindenmayer 2002). Hollows in eucalypts usually take over 100 years to form, meaning that the clearance of hollow-bearing trees can have long term impacts for the availability of this resource for native fauna. As such, clearing of trees of any age group may greatly reduce the current and future nesting, roosting and denning resources available for native hollow-dependent fauna. The relocation of tree hollows and installation of nest boxes tailored to appeal to specific species is seen as an interim solution to the problem of hollow shortage (Goldingay and Stevens 2009).

The following management protocols will be used to mitigate the impact of the removal of tree hollows and hollow bearing trees within the project area.

4.1 Avoidance of Hollow-bearing Trees

Beyond the immediate clearance zone for the proposed rail alignment, Salini Impregilo has designated a number of larger areas for storage, lay-down and/or site office and ancillary buildings. Following determination of the location of these key work areas to avoid sensitive ecological areas as much as possible, Salini Impregilo has refined the design so as to avoid vegetation clearance to result in the retention of a large number (33) of hollow-bearing trees, causing a reduction in the number of nest boxes required as offsets for vegetation clearance.

4.2 Hollow-bearing Tree and Fauna Management

The vegetation clearance is to be guided by the following measures to minimise impact to hollow-dependent fauna. Such measures are reinforced through the Ecological Monitoring Program (Biosis 2015), Appendix 6 of the CFFMP:

- A two stage clearing process will be undertaken as per the draft Construction Flora and Fauna Management Plan (Salini Impregilo 2014). The first stage will involve the clearing of all non-habitat trees (i.e. any tree not listed in Table A1.1 or mapped in Figure 1). Habitat trees will be left standing for a minimum of 24 hours, encouraging resident fauna to move of their own accord.
- Where hollow-bearing trees are to be removed, the operation will be performed by felling and not with the use of an excavator. These trees will be carefully lowered to the ground to minimise harm to resident fauna and, once felled, will immediately be inspected by an ecologist for fauna.
- If threatened birds are found to be nesting, clearance of the tree and the trees within a ten metre radius will be postponed at least three weeks, or until the young have fledged.
- An ecologist will be engaged to:
 - relocate any healthy resident fauna prior to and during clearing of hollow bearing trees to nest boxes installed in adjacent/nearby habitat.
 - rescue any injured fauna and transfer to a wildlife carer.
- After the completion of fauna relocation, a brief record detailing the findings of the survey and relocation will be prepared. Records of fauna relocations will be used to improve fauna habitat identification, relocation methodologies and general fauna management as the clearing proceeds.

4.3 Nest Box Installation

Nest box installation, in accordance with condition E6 of the CoA, is recommended for all tree hollows that will be lost as a result of vegetation clearance within the project area. A ratio of 1:1 for nest boxes per hollows being removed is recommended. This ratio is recommended in Guide 8: Nest boxes of the Biodiversity Guidelines (RTA 2011), has been applied in other areas of the North West Rail Link (Australian Museum Consulting 2013) and is deemed appropriate for the SVC works project.

Provision of nest boxes at a ratio of greater than 1:1 would not result in a net ecological gain, although this has been recommended for other infrastructure projects. Provision of shelter and/or breeding resources in addition to those already present may promote an over-abundance of fauna species beyond the carrying capacity of available forage habitat (Catry *et al.* 2013). An over-abundance of hollow resources would also provide additional shelter and breeding habitat for introduced pest and/or common aggressive species (Harper *et al.* 2005), including.

- Common Myna *Acridotheres tristis*.
- European Honey Bee *Apis mellifera*.
- Common Brushtail Possum *Trichosurus vulpecula*.
- Rainbow Lorikeet *Trichoglossus haematodus*.

The selection of appropriate nest box size and design (as per Franks, 2006) should accurately reflect the habitat resources being removed for the project. The size categories of hollows recorded during the initial pre-clearance surveys for the project are used as an indicator for the design, size and targeted fauna species for each nest box to be installed.

Table 1 provides suggested numbers of nest boxes and types to adequately offset the 161 hollows being lost.

Table 1: Suggested number of nest box types

	Insectivorous bat boxes	Small bird boxes	Medium parrot boxes	Large parrot boxes	Possum boxes	Large owl boxes
Number:	49	46	27	27	10	2

Nest boxes are to be located in large areas of intact adjacent vegetation (providing adequate forage resources for hollow-dependent fauna) as close to the alignment as possible to offset the removal of hollows during clearing. Given most vegetation remaining will be narrow linear and/or small patches it is not recommended that all nest boxes be located in these areas. To do so would likely exacerbate competition for resources and increase the abundance of pest species as described above.

The majority of nest boxes should therefore be installed in suitable trees within the following Council reserves to ensure that they are located within large areas of suitable forage habitat:

- William Harvey Reserve, Ironbark Ridge Reserve and Bruce Purser Reserve, which run parallel to the alignment (Figure 2).
- Cudgegong Reserve and Fyfe Reserve (Figure 2).

The numbers, types and densities of nest boxes to be installed in offset areas should be determined by the overall size of patches of vegetation present, known/potential fauna occurring and availability of hollow resources. These are described in the Biodiversity Offset Plan for the project.

The following requirements for the installation of nest boxes are to be adhered to:

- At least half of the required nest boxes will be installed prior to commencement of vegetation clearance. This will ensure that fauna which must be relocated during clearance have somewhere to be relocated to, whilst also allowing flexibility as to the final numbers of nest boxes required.
- Any further nest boxes which are required will be ordered and installed within one month of the completion of vegetation clearance.
- A range of nest boxes will be selected for installation, and will be based upon the types/sizes of hollows recorded and the fauna species known and likely to occur within the project area.
- No more than two nest boxes will be installed in any one tree.
- Host trees for nest box installation are to be located in adjacent/nearby habitat which will not be subject to planned future development or other vegetation clearance. Potential areas are outlined in Figure 2.

In addition to the use of nest boxes to replace the loss of potential shelter and breeding habitat for arboreal species and birds, hollows shall be salvaged wherever practical during vegetation clearing and translocated to the ground in adjacent habitat to provide shelter resources for terrestrial fauna.

Biodiversity Guidelines: Protecting and managing Biodiversity on RTA projects (Roads and Traffic Authority of NSW 2011) provides useful information guiding the installation of nest boxes, including recommendations on appropriate attachment methods, height and spacing of different types of nest boxes.

4.4 Monitoring and Maintenance

A monitoring program is critical in determining the overall effectiveness of nest boxes, and to ensure that maintenance requirements are identified and implemented appropriately.

Initial monitoring should be undertaken during and immediately following construction. Monitoring should then be undertaken between 6 to 12 months following construction, and annually (preferably in summer) for a period of up to five years. Ground-based monitoring (using pole-mounted cameras) should be undertaken by an appropriately trained ecologist. A qualified tree-climber may also be employed to assist in monitoring where ground-based methods are not possible.

During each monitoring period, notes will be made regarding the overall condition of each nest box (including damage to boxes or occupation by pest species). This information will then be used to inform nest box maintenance requirements.

Monitoring and maintenance requirements of the Nest Box Plan are detailed in the Ecological Monitoring Plan (Biosis 2015).

4.5 Summary and Timing of Management Actions

Table 2 provides a summary of the management actions detailed in this Nest Box Plan, the timing of each action, and the associated responsibilities.

Table 2: Summary of management actions, timing and responsibilities

Ref #	Action	Timing of action	Description	Responsibility
1	Avoidance of hollow-bearing trees	Pre-clearance	Refine project plans to avoid clearance of hollow-bearing trees.	Salini Impregilo
2	Nest box installation	Half of the required nest boxes to be installed pre-clearance; remainder to be installed at least two months post-clearance	Nest boxes are to be ordered and installed in the following reserves: William Harvey Reserve, Ironbark Ridge Reserve, Bruce Purser Reserve, Cudgegong Reserve and Fyfe Reserve. Nest box construction and installation to be guided by: Franks (2006).	Salini Impregilo/appointed ecologist
3	Removal of hollow-bearing trees	At least 24 hours after the removal of non-habitat trees.	Hollow-bearing trees are to be removed by felling and not with the use of an excavator. Each hollow-bearing tree will be carefully lowered to the ground and immediately inspected by an ecologist for fauna.	Salini Impregilo/appointed ecologist
4	Fauna management procedure	During clearance of hollow-bearing trees	An ecologist is to be engaged to supervise the removal of hollow-bearing trees and relocate any healthy resident native fauna to nest boxes installed in adjacent habitat and to transfer any injured fauna to a wildlife carer.	Salini Impregilo/appointed ecologist
5	Monitoring and maintenance of nest boxes	Post-clearance	Monitoring and maintenance requirements are outlined in the Ecological Monitoring Plan (Biosis 2015).	Salini Impregilo/appointed ecologist
6	Reporting	Upon completion of vegetation clearance and following each nest box monitoring survey	A brief record detailing the results of the vegetation clearance is to be prepared, including the details of any injured or uninjured fauna encountered. Brief monitoring reports are to be produced following each nest box monitoring session, as outlined in Biosis (2014).	Salini Impregilo/appointed ecologist

References

- Australian Museum Consulting (2013). *North West Rail Link TSC Works Nest Box Plan*. Consultancy report to Thiess John Holland Dragados.
- Biosis (2015). North West Rail Link – Surface and Viaducts Civil Works: Ecological Monitoring Plan. Report for Salini Impregilo. Biosis Pty Ltd, Sydney. Project no. 17941.
- Catry I, Franco AMA, Rocha P, Alcazar R, Reis S, *et al.* (2013). Foraging Habitat Quality Constrains Effectiveness of Artificial Nest-Site Provisioning in Reversing Population Declines in a Colonial Cavity Nester. *PLoS ONE* 8(3): e58320. doi:10.1371/journal.pone.0058320
- Department of Premier and Cabinet (2011). New South Wales Government Gazette No. 97. (Department of Premier and Cabinet 2011). 30 September 2011 Week No. 39/2011 page 5705 – 5927
- Eco Logical Australia (2012). Ecological Assessment for the North West Rail Link. Prepared for Transport for NSW.
- Franks, Alan and Stacey (2006) *Nest Boxes for Wildlife – A Practical Guide*
- Gibbons and Lindenmayer (2002). *Tree hollows and wildlife conservation in Australia*. CSIRO Publishing: Melbourne .
- Goldingay and Stevens (2009). Use of artificial tree hollows by Australian birds and bats. *Wildlife Research* 36, 81-97.
- Harper, M. J., McCarthy, M. A. and van der Ree, R. (2005). The use of nest boxes in urban natural vegetation remnants by vertebrate fauna. *Wildlife Research* 32: 509–516.
- RTA (2011). *Biodiversity Guidelines: Protecting and managing Biodiversity on RTA projects*. Roads and Traffic Authority of NSW, September 2011.
- Salini Impregilo (2014). North West Rail Link – Surface and Viaducts Civil (SVC) Works - Construction Flora and Fauna Management Plan. Draft report.

Appendices

Appendix 1: Tree Hollow Data

A1.1 Hollow-bearing trees recorded from the project area

Note, this data (Table A1.1) should be cross referenced with Figure 1 within this Appendix.

Table A1.1: Summary details of all hollow-bearing trees and tree hollows recorded across the project area

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
1	1	384153.77	6356389.23	<i>E. crebra</i>	branch	spout	M	1	10	potential for additional small fissures	yellow
2	2	309231.82	6266458.54	<i>E. crebra</i>	branch	spout	S	1	11		yellow
					branch	spout	M	1	10		yellow
					branch	spout	S	1	12		yellow
3	3	309266.84	6266441.15	<i>E. crebra</i>	branch	fissure	S	1	12		yellow
4	4	309260.01	6266439.68	<i>E. crebra</i>	branch	spout	M	1	8		yellow
					branch	spout	S	1	15		yellow
					branch	spout	S	1	7		yellow
5	5	309343.56	6266512.58	<i>E. crebra</i>	branch	spout	M	1	7		yellow
					branch	spout	S	1	12		yellow
6	6	309355.31	6266523.02	<i>E. fibrosa</i>	trunk	fissure	L	1	5	approx. height. Fissure runs length of trunk	yellow
					branch	spout	S	1	8		yellow
					branch	spout	S	1	8		yellow
					branch	spout	M	1	15		yellow
7	7	309349.4	6266526.78	<i>E. crebra</i>	branch	spout	S	1	8		yellow
					branch	spout	M	1	10		yellow
					branch	spout	M	1	10		yellow
					branch	spout	S	1	8		yellow

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
8	8	309335.01	6266518.29	<i>E. crebra</i>	branch	spout	S	1	8		yellow
					trunk	fissure	M	1	5		yellow
					branch	spout	M	1	10		yellow
					branch	spout	L	1	10		yellow
					branch	spout	L	1	10		yellow
9	9	309314.77	6266506.23	<i>E. crebra</i>	branch	spout	S	1	15		yellow
					trunk	fissure	L	1	10		yellow
					branch	fissure	M	1	10		yellow
10	10	309338.81	6266583.49	<i>E. crebra</i>	branch	spout	M	1	6		yellow
					branch	spout	S	1	10		yellow
					branch	spout	M	1	12		yellow
11	11	309292.32	6266608.85	<i>E. crebra</i>	trunk	fissure	M	1	12		yellow
12	12	309265.81	6266627.3	<i>E. crebra</i>	limb	spout	L	1	3		yellow
					limb	spout	L	1	3		yellow
					branch	spout	M	1	5		yellow
					branch	spout	M	1	5		yellow
13	13	309186.3	6266611.62	<i>E. crebra</i>	trunk	fissure	L	1	1.5	vacant	yellow
					branch	spout	M	1	8		yellow
14	14	309107.48	6266631.57	<i>E. crebra</i>	branch	spout	M	1	10		yellow
					branch	fissure	S	1	10		yellow
					branch	fissure	M	1	10		yellow
16	16	309126.48	6266701.51	<i>E. crebra</i>	branch	nest	M	1	15	stick nest at top of tree, possibly Raven	yellow

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
										nest	
					branch	spout	S	1	20		yellow
					branch	spout	M	1	5		yellow
15	15	309174.5	6266710.9	<i>E. crebra</i>	branch	nest	M	1	20		yellow
					limb	spout	M	1	12		yellow
17	17	309185.98	6266725.33	<i>E. crebra</i>	branch	spout	L	1	10		yellow
					branch	spout	S	1	5		yellow
					branch	spout	S	1	10		yellow
					branch	spout	M	1	12		yellow
18	18	309196.9	6266698.48	<i>E. crebra</i>	trunk	fissure	L	1	2		yellow
					branch	spout	S	1	10		yellow
					branch	spout	S	1	9		yellow
					branch	spout	M	1	12		yellow
19	19	309234.99	6266717.66	<i>E. crebra</i>	limb	spout	M	1	15		yellow
					branch	spout	S	2	15		yellow
20	20	309283.93	6266732.17	<i>E. crebra</i>	limb	spout	M	1	15		yellow
					branch	spout	M	1	25		yellow
21	21	308963.11	6266966.62	<i>E. crebra</i>	branch	spout	M	1	15	two trees immediately adjacent to each other. South tree contains hollows, however treat as one tree and have ecologist present for removal of both.	pink
					branch	spout	S	1	15		pink
					branch	spout	S	1	12		pink

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
					branch	spout	L	1	13		pink
23	23	308977.95	6266966.25	<i>E. crebra</i>	branch	spout	M	1	13		pink
					branch	spout	M	1	13		pink
					branch	spout	S	1	15		pink
					branch	spout	S	1	12		pink
22	22	309013.07	6267032.08	Stag (dead Eucalypt)	limb	spout	L	1	8		pink
					branch	spout	S	1	10		pink
					branch	spout	S	1	12		pink
					branch	fissure	M	1	20		pink
24	24	308925.92	6267092.47	<i>E. crebra</i>	limb	spout	M	1	8		pink
					branch	spout	S	1	12		pink
					branch	fissure	S	1	12		pink
					branch	spout	M	1	10		pink
25	25	308925.67	6267104.89	<i>E. crebra</i>	branch	spout	M	1	6		pink
					branch	spout	S	1	6		pink
					branch	spout	M	1	12		pink
26	26	308853.04	6267218.15	<i>E. crebra</i>	limb	spout	M	1	8		yellow
					limb	spout	M	1	16		yellow
					branch	spout	S	1	12		yellow
					branch	spout	M	1	18		yellow
27	27	308852.71	6267216.15	<i>E. crebra</i>	branch	spout	M	1	15		yellow
					branch	spout	M	1	17		yellow
					branch	fissure	S	1	12		yellow

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
28	28	308856.47	6267218.22	<i>E. crebra</i>	limb	fissure	L	1	10		yellow
					limb	spout	M	1	14		yellow
					limb	spout	M	1	14		yellow
29	29	308810.14	6267309.49	<i>E. crebra</i>	branch	spout	M	1	8	half of trunk dead, potential for additional fissures	yellow
					branch	spout	M	1	8		yellow
					branch	spout	M	1	8		yellow
					branch	spout	S	1	4		yellow
					branch	spout	S	1	4		yellow
					branch	spout	S	1	4		yellow
					branch	spout	S	5	6		yellow
30	30	308783.58	6267413.91	<i>E. crebra</i>	trunk	hollow	L	1	7		none
					branch	spout	S	5	10		none
					branch	spout	M	1	12		none
31	31	308756.31	6267446.99	<i>E. crebra</i>	trunk	hollow	M	1	20	evidence of occupation - scratched/smoothed entrance	none
					branch	nest	M	1	25	stick nest at top of tree, possibly Raven	none
					branch	spout	M	1	8	evidence of occupation - scratched/smoothed entrance	none
					branch	spout	M	2	12	Flaking at base of tree	none
32	32	308753.89	6267563.43	<i>E. crebra</i>	branch	spout	M	1	8		none
					trunk	fissure	L	1	13		none
					branch	spout	S	1	15		none

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
33	33	308743.12	6267573.09	<i>E. crebra</i>	branch	spout	S	1	15		none
					branch	spout	S	1	20		none
34	34	308535.41	6267917.3	<i>E. tereticornis</i>	branch	spout	S	1	8		none
					limb	hollow	M	1	8	worn - evidence of occupation	none
35	35	308371.86	6268309.99	<i>E. tereticornis</i>	branch	spout	S	6	15		none
36	36	308350.67	6268358.82	Stag (dead Eucalypt)	trunk	hollow	S	1	7		none
					trunk	hollow	S	1	9		none
					branch	spout	L	1	12		none
					branch	spout	L	1	12		none
					trunk	fissure	M	3	15		none
					trunk	fissure	M	1	4		none
37	37	308345.86	6268400	<i>E. amplifolia</i>	branch	spout	S	1	15		none
					branch	spout	M	1	15		none
					branch	spout	M	1	20		none
					trunk	hollow	L	1	6		none
38	38	308348.57	6268417.47	<i>E. amplifolia</i>	branch	spout	S	6	15		none
					branch	spout	M	1	12		none
39	39	308313.49	6268636.22	Stag (dead Eucalypt)	limb	spout	L	1	18	Common Starlings perched on branches - potential occupants?	none
					limb	spout	L	1	18	Bark coming off in large slabs	none
					limb	spout	L	1	18		none
					limb	spout	L	4	22		none

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
					branch	spout	M	5	15		none
					branch	fissure	M	5	15		none
40	40	308253.53	6268754.83	Stag (dead Eucalypt)	branch	spout	S	2	15	no obvious hollows, a few spouts	pink & black
					branch	spout	M	1	15		pink & black
41	41	306295.92	6270212.61	Stag (dead Eucalypt)	trunk	fissure	S	1	throughout	several small fissures throughout	pink & black
42	42	306324.52	6270219.96	Stag (dead Eucalypt)	trunk	hollow	M	1	20		pink & black
					limb	spout	M	3	25		pink & black
					branch	spout	S	3	8		pink & black
					trunk	fissure	S	1	6	long fissure, small opening	pink & black
43	43	306482.49	6270259.55	Stag (dead Eucalypt)	branch	spout	S	1	12	Bark coming off in large slabs	pink & black
44	44	306489.43	6270260.24	Stag (dead Eucalypt)	branch	spout	S	2	12		pink & black
					branch	spout	M	1	11		pink & black
45	45	306653.96	6270076.73	Stag (dead Eucalypt)	branch	spout	S	4	5		pink & black
					trunk	hollow	M	1	3		pink & black
46	46	306654.59	6270077.52	Stag (dead Eucalypt)	trunk	fissure	M	1	10		pink & black
					limb	spout	M	2	12		pink & black
					trunk	spout	L	1	12		pink & black
					branch	spout	S	2	8		pink & black
48	48	306665.29	6270075.97	<i>E. tereticornis</i>	limb	spout	M	3	12	flaky	pink & black
					branch	spout	S	2	10		pink & black
					trunk	fissure	S	2	7	long fissure (approx. 1 m), small opening	pink & black

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
47	47	306659.6	6270073.08	<i>E. molucanna</i>	limb	spout	M	1	10		pink & black
					limb	spout	S	1	10		pink & black
49	49	306297.46	6270241.6	Stag (dead Eucalypt)	trunk	fissure	S	5	throughout	many fissures all over	pink & black
					limb	spout	L	1	10	potential, difficult to tell from ground	pink & black
50	50	306711.4	6270249.42	Stag (dead Eucalypt)	trunk	fissure	S	5	4	long fissures, small openings	pink & black
					branch	spout	S	2	4		pink & black
					branch	spout	S	2	6		pink & black
					branch	spout	S	2	10		pink & black
51	51	306767.17	6270303.24	<i>E. crebra</i>	limb	spout	vL	1	5	Upwards facing, fissures also present. Flaking bark. Rainbow Lorikeet in tree - potential occupant	pink & black
					limb	fissure	L	1	5	long fissure.	pink & black
					branch	spout	M	3	10		pink & black
					branch	spout	S	3	12		pink & black
52	52	306821.2	6270305.33	<i>E. crebra</i>	trunk	fissure	S	1	6	long	pink & black
				<i>E. crebra</i>	trunk	hollow	M	1	12		pink & black
53	53	307028.28	6270342.79	<i>E. tereticornis</i>	branch	spout	S	6	15		pink & black
					branch	spout	M	4	13		pink & black
					branch	fissure	S	4	10		pink & black
54	54	307083.19	6270310.17	<i>E. tereticornis</i>	trunk	hollow	L	1	20		pink & black
					trunk	hollow	M	1	30		pink & black
					trunk	hollow	M	1	25		pink & black
					trunk	hollow	M	1	15		pink & black

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
					limb	hollow	M	1	10		pink & black
					branch	spout	S	1	3		pink & black
					branch	spout	S	1	6		pink & black
					branch	spout	S	2	15		pink & black
					branch	spout	M	1	7		pink & black
					branch	spout	S	1	18		pink & black
55	55	307864.87	6269758.53	<i>E. crebra</i>	trunk	spout	vL	1	20		pink & black
					branch	spout	S	2	18		pink & black
					branch	spout	S	1	10		pink & black
					branch	spout	S	1	20		pink & black
56	56	307871.61	6269741.8	<i>E. crebra</i>	trunk	hollow	M	1	15	Rainbow Lorikeets pair present at hollow entrance	pink & black
					branch	spout	M	1	20		pink & black
					branch	spout	S	2	23		pink & black
					branch	spout	S	1	17		pink & black
57	57	307871.61	6269755.67	<i>E. crebra</i>	limb	spout	L	1	12	cracks and fissures (small) also present on dead parts of tree	pink & black
					branch	spout	S	1	5		pink & black
					branch	spout	M	2	15		pink & black
					branch	spout	M	2	25		pink & black
58	58	307861.95	6269737.72	<i>E. crebra</i>	branch	spout	M	1	8		pink & black
					branch	spout	S	1	10		pink & black
					branch	spout	S	1	20		pink & black

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
59	59	307873.17	6269710.43	<i>E. crebra</i>	trunk	hollow	L	1	20	long, large hollow in trunk	pink & black
					limb	fissure	S	1	6		pink & black
					limb	fissure	S	1	8		pink & black
					branch	spout	M	2	10		pink & black
60	60	307885.06	6269685.93	<i>E. crebra</i>	branch	spout	S	4	20		pink & black
					branch	spout	S	2	10		pink & black
					branch	spout	S	2	12		pink & black
61	61	308088.53	6269255.77	Stag (dead Eucalypt)	limb	hollow	M	1	10	clump of stags, small numbers of small - medium spouts present	pink & black
					branch	spout	M	2	12		pink & black
					branch	spout	S	5	15		pink & black
62	62	308398.38	6268296.09	<i>E. amplifolia</i>	branch	spout	S	4	15	overhanging creek.	none
63	63	308385.6	6268374.17	<i>E. amplifolia</i>	branch	spout	S	2	7		none
					branch	spout	S	2	12		none
64	64	308382.81	6268383.98	<i>E. tereticornis</i>	trunk	hollow	L	1	3		none
					trunk	hollow	M	1	5		none
					trunk	fissure	S	1	4	various	none
					trunk	hollow	L	1	5		none
					trunk	hollow	S	1	2		none
					limb	spout	S	1	13		none
65	65	308379.29	6268402.33	<i>E. tereticornis</i>	branch	spout	S	2	25	hollows appear to be utilised	none
					trunk	hollow	L	1	10		none

Tree #	Waypoint	GPS coordinates		tree species	Tree hollows present					notes	Flagging tape used to mark tree
		Easting	Northing		Location	Type	Size	number	Height (m)		
					branch	spout	M	1	8		none
					branch	spout	M	1	6		none
					branch	spout	M	1	5		none
					branch	spout	M	1	4		none
					branch	spout	M	2	8		none
66				<i>E. crebra</i>	limb	spout	S	1	3		pink & black
					branch	spout	M	1	15		pink & black
					branch	spout	S	3	22		pink & black

Note: the Amber tiles property was unable to be accessed during Project surveys

APPENDIX 8: Agency Consultation

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



**PLAN & REVISION No: Construction Flora and Fauna Management Plan
NWRLSVC-ISJ-SVC-PM-PLN-120208 Rev 1**

REVIEWER: Michael Lathlean (Manager – Infrastructure Special Projects) - The Hills Shire Council

SECTION / PAGE	COMMENT	HOW ADDRESSED
General	The plan provides actions for the protection of sensitive flora and fauna including threatened species and vegetation communities and for the rescue and relocation of fauna encountered whilst undertaking the construction works. Appropriate fencing and signage have been planned for those areas and trees that require protection and training has been proposed to educate staff on the implementation of the plan.	N/A
Mitigation Measures	The Mitigation Measures which refer to the rehabilitation of watercourses to emulate natural stream systems contains a vague “where feasible and reasonable”. These vague references should be removed from the documentation. It is not unreasonable to expect that where the proposed works affect watercourses, that they be rehabilitated as a natural area and not landscaped as a park.	“where reasonable and feasible” came from CoA wording. Wording tightened to remove 'where feasible and reasonable' (FF12, FF42, FF52, FF54, FF56).
Mitigation Measures	Similarly, mitigation measure FF53 states “Where possible, riparian vegetation disturbed by construction works will be replaced with endemic species”. It goes on to state that bank stabilisation may be required via another method. This remains unclear as to when endemic species will be used. This measure should state that endemic species will be used in all watercourse rehabilitation works. Where other methods of bank stabilisation are required to be used, the size of the plantable area may be reduced.	Text added to FF53 "(using endemic species)"
Description of the SVC Project Works – Page 10	In the list of permanent infrastructure to be delivered, no mention is made of the realignment of Balmoral Rd at the Miami Ave/Old Windsor Rd intersection and the construction of a new bridge over the railway cutting on Balmoral Rd. I made a similar comment in my response to the Draft Construction Traffic Management Plan	Following text added to the description of SVC works as per Constructon Traffic Mangement Plan Rev [2]: •A bridge over Balmoral road •Balmoral Road realignment
Appendix 4	ISJV may need to seek some advice from TfNSW and/or others on this in relation to compliance with the NSW Pesticides Regulation 2009. Of particular relevance is Clause 19 of the Regulation.	Text added "Chemical usage to be done so in accordance with the NSW <i>Pesticides Regulation 2009</i> ."
Nest Box Plan and Ecological Monitoring Program Consultation – June/July 2014 - Mark Chidel (Senior Biodiversity Officer) - The Hills Shire Council		

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



SECTION / PAGE	COMMENT	HOW ADDRESSED
Appendix 6	Council would like to see that nest boxes placed in Council parks/reserves are monitored.	Council were assured that installation will be guided and monitoring is set out on an annual basis for five years. CFFMP in full to be provided to Council for their records.
Appendix 7 – Consultation was sought as to suitable parks reserves in The Hills Shire Council area.	Mark Chidel commented 'Lisa Willock is Council's Bushland Maintenance Coordinator and she may know of some bushland reserves where it may be possible to install nest boxes. The one that comes to mind is Bella Vista Farm. You can also speak to Lisa about the local provenance plants as she works closely with our nursery but also bush regenerators.	Through consultation, the reserve/park locations chosen (within close proximity to the SMNW alignment (where habitat trees are being lost) include: 1. William Harvey Reserve 2. Ironbark Ridge Reserve 3. Bruce Purser Reserve
Rehabilitation	Council provided a preferred list of bushland regenerators for consideration with regard to regeneration/rehabilitation works: Apunga Ecological, Blue Tongue, Ecohort, Drangon Fly Environmental, Toolijooa and Bushland Management Solutions.	To be considered by Salini Impregilo

**PLAN & REVISION No: Construction Flora and Fauna Management Plan
NWRLSVC-ISJ-SVC-PM-PLN-120208 Rev 1**

REVIEWER: Rudi Svarc / Blacktown City Council

SECTION / PAGE	COMMENT	HOW ADDRESSED
Section 2.1 / p12	Ministerial conditions missing. No Ecological Monitoring Program provided.	CoA's C1 and C23 have been added into CFFMP in Section 4.1 and 4.2. Ecological Monitoring Program now included in CFFMP as Appendix 6.
Document History Section / p2	The Ecological Monitoring Program is to be developed by a suitably qualified and experience ecologist. Document Revision history does not contain authors details.	Biosis (Leaders in Ecology and Heritage) have developed the Ecological Monitoring Program, and consulted on the development of This Plan. Credentials added in Document History section of This Plan.
Abbreviations / p4	Abbreviation for Endangered Ecological Community EEC not ECC	Typo corrected to EEC.
S1.2 / p7	PQP term to be in full and added to Abbreviations list if used again.	PQP defined in text as Project Quality Plan. Term is not used again.
S1.3 / p7	E46 (f) (SSI 5100), E34(f) (SSI 5414) not addressed. Sensitive Area Maps not included in Appendix 1. Sensitive Area Maps referred to are from Ecological and include EECs and threatened fauna only. No reference to maps showing important flora and fauna habitat, although impacted GGBF habitat map	Sensitive Area Maps now included in Appendix 1. Text added in Section 1.3 to indicate: "Migratory species have not been included based on the EIS impact assessment determining that

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



SECTION / PAGE	COMMENT	HOW ADDRESSED
	referred to. Unclear if no other important habitat occur within impacted or adjoining areas, including habitat areas important to migratory species as two species were recorded in 2011 surveys (EIS Stage 2).	there would be negligible impact to any migratory species."
S3 / pp17-19	Stage 1 Submissions Report not available on SMNW website to confirm that all relevant requirements included in the CCFMP.	TNSW double checking that all relevant requirements are included in the CCFMP.
S4 / pp21-23	Unable to confirm if all requirements from Deed, SWTC and CEMF included within CCFMP.	TNSW double checking that all relevant requirements are included in the CCFMP.
S6 / p25	Include section before table that define roles with responsibility for Actions, eg SS, EC, CM etc. Review of Responsibility required for all mitigation measures with a Design timeframe have been assigned to roles that may have been assigned roles that may have little influence over design components of the Project.	Roles and Responsibilities defined in section 4.4 of the CEMP.
FF1 / p25	Appendix 1 of CCFMP not included. VMPs as required by CoA for retained vegetation and riparian zones not included. Timing for Design phase only, delete reference to Construction.	Sensitive Area Maps now included in Appendix 1. VMPs represented as Rehabilitation Site Plan. Timing deleted for Construction.
FF2 / p25	Responsibility for flagging habitat trees for removal assigned to the Ecologist. Timing for design phase only, delete reference to Construction.	Responsibility assigned to Ecologist for FF2 in accordance with Vegetation Pre-Clearing Procedure. Reference to Construction deleted.
FF4/ p25	Limits of Clearing. Timing for Design phase only, delete reference to Construction.	Deleted reference to Construction.
FF5 / p26	Consultation with Bushcare groups. Timing prior to Vegetation Clearance and as Needed.	Text amended.
FF6 / p26	Sensitive Environmental Area. CoA refers to important flora and fauna habitat areas as well. If additional areas occur within or adjoining project area they need to be mapped prior to construction and included as an ecologically sensitive area.	Pre-clearing surveys will identify any additional areas. Additional text added to FF10 re updating SAMs and Ecological Monitoring Program.
FF10 / p27	Pre-clearance survey. Delete reference to emergency and incident response.	Reference deleted.
FF12 / p27	Remove reference to soil from this measure as this is dealt with in FF13. Weed species presence more relevant to topsoil retention / reuse action.	Reference removed.
FF13 / p28	Storage of topsoil needs to be carefully conducted and monitored to ensure no mixing with other sub-soil profiles as well if filling areas. Need to remove, store and replace soil profiles in correct order if intention is to re-instate native vegetation. Recommend preparation of Soil Translocation Management Plan.	This text added into FF13. FF13 highlighted as one for induction.

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



SECTION / PAGE	COMMENT	HOW ADDRESSED
FF30-35 / p31	The title for this section should be Construction Lighting and Noise. All mitigation measures should be edited and included into one mitigation measure FF36. Review all actions for lighting and noise to ensure they are best practice to limit disturbance to nocturnal / sensitive flora.	Title changed to Construction Lighting and Noise. Actions for lighting and noise have been reviewed by the Projects Principal Ecologist.
FF37 / p32	Aquatic Flora Fauna. Appendix 1 not included.	Appendix 1 now included.
FF42 / p33	VMPs for Riparian zones. Appendix 8 VMPs not included.	VMPs represented as a separate document entitled Vegetation Management Plan
FF51 / p35	Restoration and Rehabilitation Plans. It is unclear if these Plans are related to vegetation management or other actions within the riparian zone. If the former, then should be part of VMPs identified elsewhere in the CFFMP. CoA E46(f)(v) requires rehabilitation details and these have not been provided.	These Plans will relate to both vegetation management and reaches of riparian zones that intersect with the construction footprint. This will be included in the Vegetation Management Plan.
FF53 / p36	Creek bank stabilisation. The use of other vegetation to stabilize creek banks ok as long as end goal is revegetation with endemic species. This is not relevant if non-vegetation stabilisation methods required.	FF53 reworded to make revegetation with endemic species the priority. Also rephrased to make clearer.
FF57 / p 36	Weed removal. Removal of weeds within native vegetation areas to be retained is to be conducted by qualified bush regenerators. Weed removal within construction footprint may be undertaken by others as per agreed methodologies documented within VMPs to limit spread of weeds to other areas.	Added detail into FF57
FF63 / p38	Effective weed management and weed control methods not detailed. All weed control and maintenance activities within retained vegetation and riparian zones as per approved VMPs. VMPs to include performance measures that need to be met within agreed timeframes, and include rectification measures for non-conformance linked to monitoring program.	Added in reference to Weed Management Procedure and Vegetation Management Plan in FF63.
FF64-70 / pp38-39	All revegetation actions, including seed collection and timing, habitat augmentation, topsoil management and re-use, nest boxes etc should be part of approved VMPs or detailed within Rehabilitation Plans, a separate Soil Translocation Plan and Nest Box Plan that is required.	Will be included in Vegetation Management Plan
Section 7 / Monitoring	The Conditions of Approval require the development of an Ecological Monitoring Program which has not been provided. Section 7 does not contain the required range, scale, frequency, and standards of monitoring in order to measure effectiveness or otherwise of biodiversity mitigation	Ecological Monitoring Program now provided in Appendix 6 of Revision 2 of CFFMP. Required range, scale, frequency, and standards of monitoring in order to

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



SECTION / PAGE	COMMENT	HOW ADDRESSED
	measures.	measure effectiveness or otherwise of biodiversity mitigation measures are detailed in the Ecological Monitoring Program.
Section 8 / Incident Planning and Response	This section should include information of reporting requirements for the range of potential incidents documented. Reporting included internal, EMR and also external agencies.	Reporting requirements has been updated for this section.
Section 9 / Training & Resources	Training requirements to be supported by Appendices however these are incomplete. No details related to spoil management or topsoil management and retention and re-use of soil seedbank. The ecological component and flora and fauna component are the same and should be combined into one list of induction topics relevant to the project and work sites. The Resources section is incomplete and needs development.	Appendices are now complete and included. Ecological and flora and fauna component of induction combined and expanded to explain which procedures are covered where. Retention and re-use of soil seedbank covered in FF64 and FF66. For details on spoil management, refer to Spoil Management Plan (NSWRSVC-ISJ-SVC-PM-PLN-120213). Resources section further developed.
References and Revisions	Revision Control and Amendment section does not address the full requirements of CoA E46(f) (ix)	CoA E46(f) (ix) mechanisms for the monitoring, review and amendment of this plan is extensively covered in section 4.2.3 of the CEMP. This reference has been added into the Reference and Revisions Table of the CFFMP.
Appendix 1	Appendix 1 refers to MS Word document but this was not provided.	Appendix 1 (SAMs) now included.
Appendix 2	Appendix 2 incomplete. Tree Inspection Record relevant to Appendix 3 rather than 2.	Appendix 2 now complete and included.
Appendix 3	Include section related to identification of weed control areas, areas suitable for topsoil reuse etc.	Appendix 3, Vegetation Pre-Clearing procedure now complete and included. Weed control areas, and areas suitable for topsoil reuse, will be clearly mapped in the SAMs once the final design and site specific construction plans are prepared.
Appendix 4	Appendix 4 incomplete. Is this supposed to be Weed Management Procedure?	Appendix 4, Weed Management Procedure, is now complete.
Appendix 5	No link to Biodiversity Offsets as required by CoA E46(f) (viii).	Components of the CFFMP and Appendices have been developed to interface with the Biodiversity Offset Plan yet to be finalised.

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



SECTION / PAGE	COMMENT	HOW ADDRESSED
Appendix 6, 7, 8	All incomplete. VMPs required for all areas of retained vegetation and riparian areas.	VMPs represented as a separate document entitled Vegetation Management Plan
Appendix 9	The purpose of this appendix is unclear. Please provide more context for the application of this table.	This table is a record of Agency Consultation (comments received and how addressed). Now populated.
Nest Box Plan and Ecological Monitoring Program Consultation – June/July 2014 – Robert Blackall (Senior Biodiversity Officer) - Blacktown Council		
Appendix 6	<p>Appendix 6 Ecological Monitoring Program Biosis (2014) Final Version 01</p> <p><u>Section 2.3. Weed and Pathogen Monitoring</u> Noxious weed control is required in all areas prior to clearing. A monitoring action related to this mitigation measure is required.</p> <p><u>Section 3.2 Monitoring Actions – Weed and Pathogen Monitoring</u> Timing is to include pre-clearance in relation to noxious weeds. A separate performance criteria for noxious weeds is required.</p> <p><u>Section 3.2 Monitoring Actions - Revegetation Monitoring</u> The CFFMP identified the need for Vegetation Management Plans. Again, the VMPs were not available during review of Version 1.0 of CFFMP. The monitoring of revegetation and rehabilitation of 'bushland' areas should be addressed in the VMP. The monitoring of landscaping should be set out in the Urban Design and Corridor Landscape Plan. The VMP and Urban Design and Corridor Landscape Plan should be submitted to Council for review</p> <p><u>Section 3.3 Timing</u> In order to conduct assessment of the data to identify changes to habitat usage as required by the Conditions of Approval, the collection of baseline data is required. This will allow comparison to data collected during and after the project, and therefore assessment of changes to habitat usage. If there will be a reliance on baseline data previously collected during the project planning phase, then this should be identified within the table. The frequency and duration of nest box and GGBF monitoring is not adequate and should be increased and extended.</p> <p>If possible, please send me the results of the GGBF survey and any noxious weed records at the boundary of the project alignment and Council land. Council sends noxious weed records to Hawkesbury River County Council who undertake control on behalf of Blacktown City Council.</p>	<p>Comments incorporated into final version Appendix 6 (18.07.2014).</p> <p>Pre-clearance data to be forwarded to Blacktown Council.</p> <p>VMPs are covered through the Vegetation Management Plan as stated in CFFMP.</p>

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



SECTION / PAGE	COMMENT	HOW ADDRESSED
Appendix 7	<p><u>Section 3 Results</u> Potential Council managed sites outside of the project alignment include Cudgegong Reserve (Reserve 260), Fyfe Reserve (R811), Eastern Neighbourhood Park (R828) and an un-named Reserve in Kellyville Ridge (R813). Other bushland areas are located within The Ponds, however these are currently managed by Landcom, but may come under the care, control and management of Council in the future.</p> <p><u>Section 4.3 Nest Box Installation</u> Figure 2 of potential nest box areas is missing, and the information supplied above may assist in compilation.</p>	<p>Comments incorporated into final version Appendix 7 (18.07.2014).</p> <p>Following consultation, the following two Council managed bushland reserves have been included within Appendix 7; Cudgegong Reserve, Cudgegong Rd Rouse Hill and Fyfe Reserve, Fyfe Rd Kellyville Ridge.</p>
Appendix 7 – Consultation was sought as to suitable parks reserves in Blacktown Council area.	<p>The following two Council managed bushland reserves are preferred as locations for fauna nest boxes.</p> <ol style="list-style-type: none"> 1. Cudgegong Reserve (R260), Cudgegong Rd Rouse Hill 2. Fyfe Reserve (R811), Fyfe Rd Kellyville Ridge <p>If additional locations are required then we can 'rank' the other Council bushland reserves previously advised.</p> <p>Can you please ensure that the details (construction type, size, target species) and locations of any nest boxes are sent to Council for our records.</p>	<p>Following consultation, the following two Council managed bushland reserves have been included within Appendix 7; Cudgegong Reserve, Cudgegong Rd Rouse Hill and Fyfe Reserve, Fyfe Rd Kellyville Ridge.</p> <p>Nest box data to be forwarded to Blacktown Council as requested during installation stage.</p>
Rehabilitation	<p>Council support the selection of plant species for revegetation that are characteristic of the two vegetation communities River-flat Eucalypt Forest and Cumberland Plain Woodland, as per the CFFMP.</p> <p>The contact for the Blacktown Council nursery is; Belinda Riley 9671 3576.</p>	<p>CFFMP highlights species selection to be guided upon the two key ecological communities within the alignment: River-flat Eucalypt Forest and Cumberland Plain Woodland.</p> <p>Belinda at Blacktown Council to be approached well in advance regarding seed collection and propagation for the project.</p>

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



**PLAN & REVISION No: Construction Flora and Fauna Management Plan
NWRLSVC-ISJ-SVC-PM-PLN-120208 Rev 1**

REVIEWER: Susan Harrison / Office of Environment and Heritage (OEH)

SECTION / PAGE	COMMENT	HOW ADDRESSED
Appendices	OEH advised in email of 12 May 2014 that "There are no further comments OEH wish to make regarding the Appendices".	OEH provided an email response after reviewing all the appendices to the Construction Flora and Fauna Management Plan on 12 May 2014.
Appendices	OEH does not have any comments on the Construction Flora and Fauna Management Plan. There are a number of attachments that are yet to be included and therefore OEH is unable to review and provide comments on these e.g. App 1 Sensitive area maps App 2 Fauna handling and rescue procedure (it says 'to be completed post field assessment') App 5 Unexpected EEC/Threatened species procedure – photos and descriptions of threatened species missing (it says 'to be inserted post field assessment') App 8 Vegetation Management Plan ('to be completed post field assessment')	Provided all Appendices to OEH 6 May 2014 for comment by COB 9 May 2014.
Nest Box Plan	Please find attached previous correspondence (14.08.2013) with regard to the Nest Box Plan to which Planning and Infrastructure was cc'd on. OEH is not in a position to review this plan.	15.April 2014

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



**PLAN & REVISION No: Construction Flora and Fauna Management Plan
NWRLSVC-ISJ-SVC-PM-PLN-120208 Rev 1**

REVIEWER: Marcel Green / Fisheries NSW (NSW Department of Primary Industries)

SECTION / PAGE	COMMENT	HOW ADDRESSED
p6	delete reference to the NSW Fisheries Management Amendment Act 1997...similarly, delete the Rivers and Foreshores Improvement Act as it was repealed by the Water Mgmt Act	References deleted in section 1.1
p32	Aquatic Flora and Fauna - this section needs to identify the potential for fish kills during the project and appropriate mitigation measures. As a minimum, in the event of a fish kill, the EPA is the Appropriate Regulatory Authority and is to be notified immediately via 131 555. Fisheries NSW should also be advised of any incidents via email to: wollstonecraft.fisheries@dpi.nsw.gov.au . Fish kills should also be referred to in Section 8 - Incident Planning and Response and in Section 9 under tool box talks.	Mitigation measures specifically include reference to aquatic flora and fauna (see FF38, 47 & 48) Text added regarding potential for fish kill to Incident Planning Response section. Text "Sensitivity of aquatic flora and fauna (particularly fish)" added under Induction section.
p33 / FF39 & p34 / FF45 & p36 / FF56	Replace the 2003 Fisheries references with this one: Policy and Guidelines for Fish Habitat Conservation and Management 2013	Replaced 2003 references in FF39, 45 & 56 as instructed.
p46	replace the old Fisheries References with the 2013 reference	Updated References Section.

NOW advised in its letter to the ISJV that it did not have any comments on this Plan.

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



Consultation with DPI (Fisheries) - July and October 2014

From: Carla Ganassin
To: Steve Fermio
Subject: Re: FW: NWRL Creek crossings - Meeting figures
Date: Monday, 13 October 2014 11:42:51 AM

Thanks Steve,
These plans look fine.

Regards,

Carla Ganassin | Regional Assessment Officer
NSW Department of Primary Industries | Fisheries NSW | Aquatic Ecosystems Unit
Block E, Level 3, 84 Crown Street, Wollongong NSW 2500
SEND MAIL TO: Locked Bag 1 | Nelson Bay NSW 2315
T: 02 4222 8342 | **F:** 02 4225 9056 | **E:** carla.ganassin@dpi.nsw.gov.au
W: www.dpi.nsw.gov.au
Conserve, Share, Provide

On 3 October 2014 10:00, Steve Fermio <steve.fermio@isjv.com.au> wrote:

Hi Carla/Rohan

I have attached some concept designs for the Surface Viaduct Works on the NWRL for your information / comment. The figures show the haul roads as green, segment laydown areas as light blue and culvert crossings at a number of tributaries of Caddies Creek.

All of the creeks will be crossed by extending existing culverts or creating new ones. There is likely to be a need for temporary (& possibly permanent) diversions of sections of creeks to enable construction of some piles and piers above.

Under Condition C4 of Planning Approval SSI-5100 for the NWRL we are required to consult with Fisheries and NOW regarding rehabilitation and restoration of riparian areas.

Detailed design is continuing and if you have any comments or wish to meet to discuss please let me know.

Kind regards

Steve Fermio
Environment Manager
Suite 701, Level 7
100 Walker Street
North Sydney, NSW 2060
Mob. [+61 417 170 645](tel:+61417170645)

This message is intended for the addressee named and may contain confidential information. If you are not the intended recipient, please delete it and notify the sender. Views expressed in this message are those of the individual sender, and are not necessarily the views of their organisation.

Tracey Austin

From: Steve Fermio
Sent: Monday, 14 July 2014 5:46 PM
To: Carla Ganassin
Cc: adam.sutton@isjv.com.au; neville.hattingh@isjv.com.au; tracey.austin@isjv.com.au; patrick.lovely@isjv.com.au; stefano.diberardino@isjv.com.au
Subject: RE: NWRL - viaduct pier locations near watercourses and access road waterway crossings.

Hi Carla

Many thanks for sending this information through and for coming out to site last week

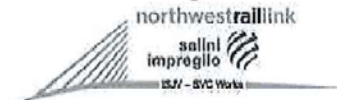
I have forwarded your email to our design team and their consideration in the design of the works near/in waterways

Once design has been further developed we will get plans back to you for review, prior to relevant works occurring.

I am going on leave for 6 weeks from this Wednesday, returning on 1 September. Neville Hattingh (cc above), will be acting Enviro Manager in my absence.

Kind regards

Steve Fermio
Environment Manager



Suite 701, Level 7
100 Walker Street
North Sydney, NSW 2060
Mob. +61 417 170 645

From: Carla Ganassin [mailto:carla.ganassin@dpi.nsw.gov.au]
Sent: Thursday, 10 July 2014 2:38 PM
To: steve.fermio@isjv.com.au
Subject: NWRL - viaduct pier locations near watercourses and access road waterway crossings.

Hi Steve,

Thank you for the opportunity yesterday to visit the following watercourses (viewed on the day in the order listed below) that will be traversed by the NWRL viaduct:

- 1 - near Merryville Road, Kellyville Ridge
- 2 - near Terry Road on Second Ponds Creek
- 3 - adjacent to Old Windsor Road and near Clovelly Circuit

I can now confirm that sites 2 and 3 above have been mapped as key fish habitat. Site 1 is not mapped as key fish habitat, but flows into key fish habitat at the next creek junction downstream.

The need for waterway crossings for the construction access road was discussed at Sites 1 and 3. Fisheries NSW provide the following guidelines to assist in the design of these crossings:

- Site 3: The waterway crossing will need to be designed according to the following document:

* Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings
(http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/202693/Why-do-fish-need-to-cross-the-road_booklet.pdf)

Basically, as a minimum, the waterway crossing at Site 3 will need to be a piped culvert or ford. It needs to be designed so that the passage of fish is maintained at all times, both during operation and construction stages.

- Site 1: At this site, there is no requirement to maintain fish passage at this site during construction and operation.

The usual flooding related etc matters will need to be considered in the design of all waterway crossings, so that the structures can withstand high rainfall events.

The need to conduct piling works next to or within the creeks was discussed at all sites. The discussed sheet pile coffer dam and sleeving methods will be fine provided that the area of waterway impacted is minimised as far as possible and fish passage is maintained during (and after) construction.

Note, all works within or adjacent to a waterway must use appropriate erosion and sediment control measures.

Please forward the designs/construction plans for the discussed works, once prepared, to Fisheries NSW for review prior to construction.

Regards,

Carla Ganassin | Regional Assessment Officer

Construction Flora and Fauna Management Plan

Surface and Viaduct Civil Works



NSW Department of Primary Industries | Fisheries NSW | Aquatic Ecosystems Unit

Suite 1, Terrace Level, Crown Tower, 200 Crown Street, Wollongong NSW 2500

SEND MAIL TO: Locked Bag 1 | Nelson Bay NSW 2315

T: 02 4254 5527 | F: 02 4225 9056 | E: carla.ganassin@dpi.nsw.gov.au

W: www.dpi.nsw.gov.au

This message is intended for the addressee named and may contain confidential information. If you are not the intended recipient, please delete it and notify the sender. Views expressed in this message are those of the individual sender, and are not necessarily the views of their organisation.

APPENDIX 9: Green Star Rating

Green Star - Office Design v3 & Office As Built v3

Credit Summary for:

Change In Ecology Calculator

Does the site contain any rare, threatened or vulnerable flora or fauna?

Yes



If yes then no credits awarded

In which bio-region is the site located?

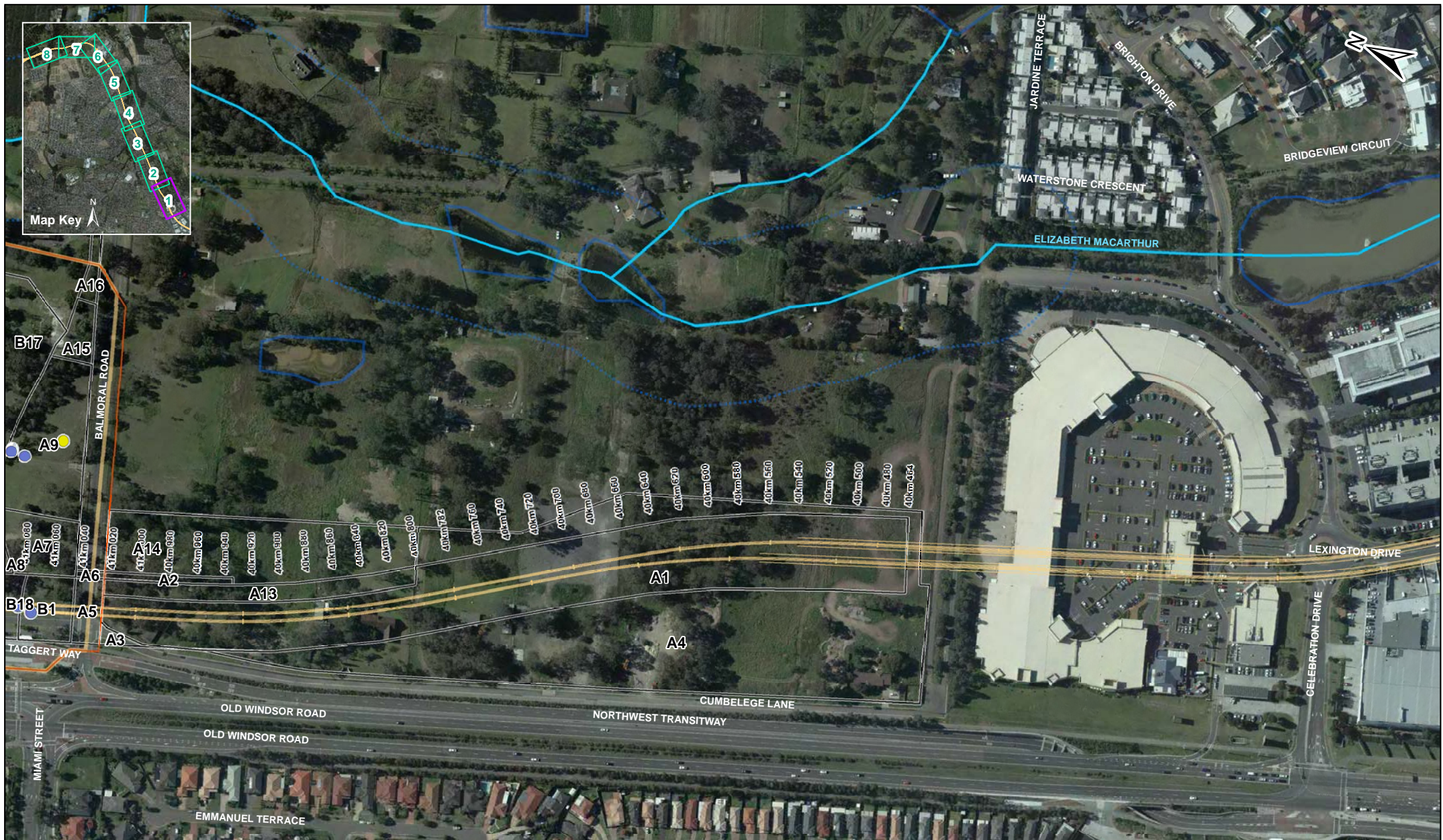
Sydney Basin



Land Type	BEFORE	AFTER
	Land Types Before Construction / m ²	Land Types After Construction / m ²
Building	6861	5890
Impermeable/concreted Area	128526	131917
Bare Ground	73993	122849
Weed Infestations		
Exotic Garden		
Native Garden		
Exotic Grazing		
Native Grazing*		
Crop Farming		
Existing Waterway*	4708	4708
Wetland*	22006	21916
Plantation Forest		
Pine Plantation Forest		
Blue Gum Plantation Forest		
Regenerated Native Habitat(< 10 years old)*		
Indigenous Native Habitat (> 10 years old)*		
Indigenous Native Habitat (> 20 years old)*	339057	287871
TOTAL	575151	575151
ECOLOGICAL DIVERSITY INDEX:	32.34	28.31
CHANGE IN ECOLOGICAL DIVERSITY INDEX	-4.03	
Points Achieved	0	

* = affected by Bioregion Reservation Importance Factor

APPENDIX 10: Weed Mapping



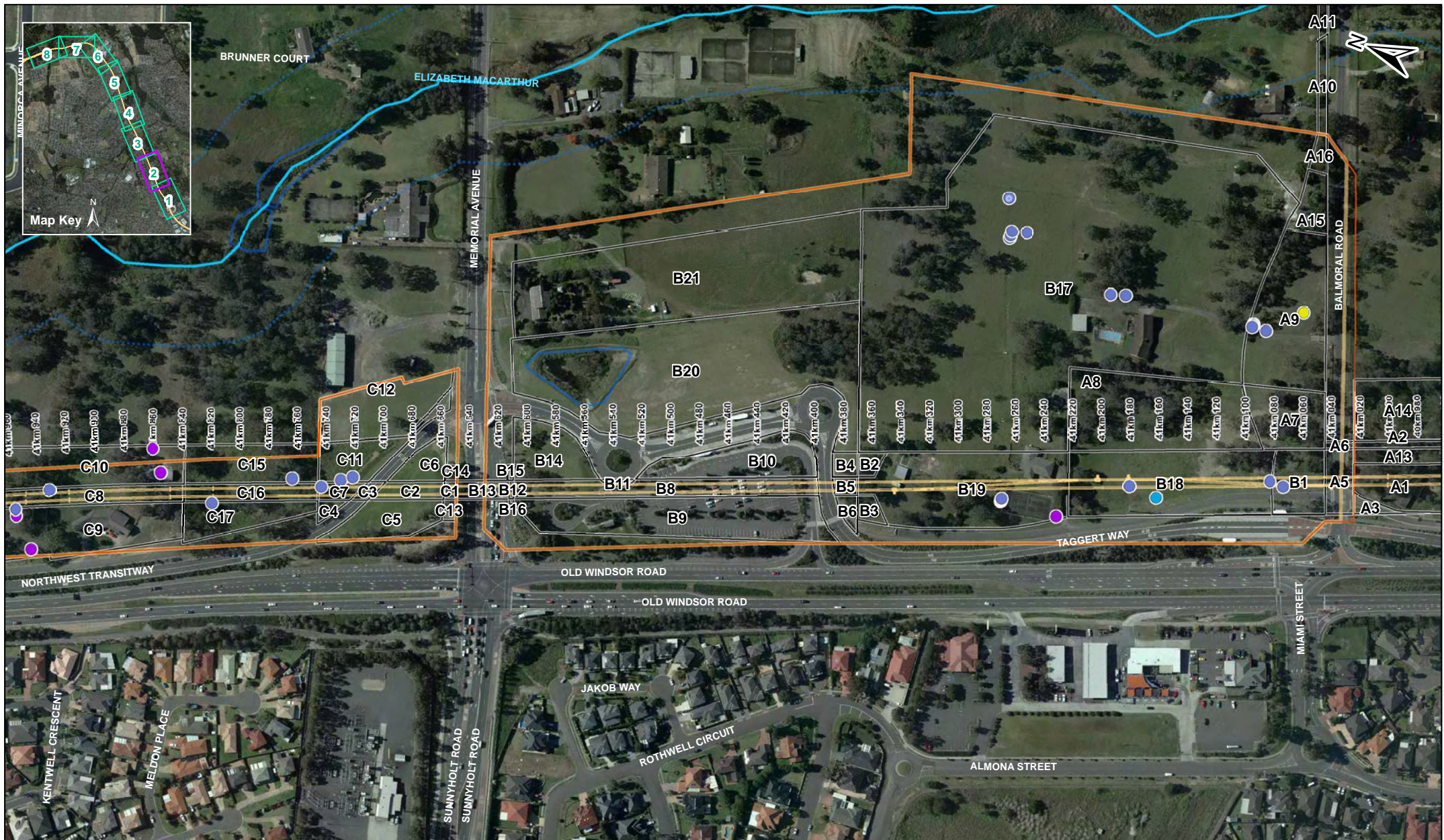
F	18/09/14	EM	Revised Noxious Weeds data		
E	19/09/14	EM	Added noxious weed records	JM	-
D	30/07/14	BH	Revised issue following site works	JM	-
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Noxious and Invasive Weeds				Individual	Infestation
● Blackberry	● Lantana	● Prickly Pear			
● Bridal Creeper	● Patersons Curse	● Thistle			
— River / Creek	— Concept Alignment: EIS2Sub				
— Water body	— Construction Boundary EIS1				
— Riparian Buffer - Approx	— Construction Boundary EIS2				

CLIENT:	Impregilo Salini Joint Venture
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 9: Celebration to Balmoral
TITLE:	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Noxious and Invasive Weeds

DESIGN-DRAWN:	BH	DATE:	SEPT 2014
SCALE:	1:2,500 @ A3		
	0 10 20 40 60 80 100		
	Meters		
DRAWING No:	FIGURE 1	REV:	F
© WSP Environmental Pty Ltd			

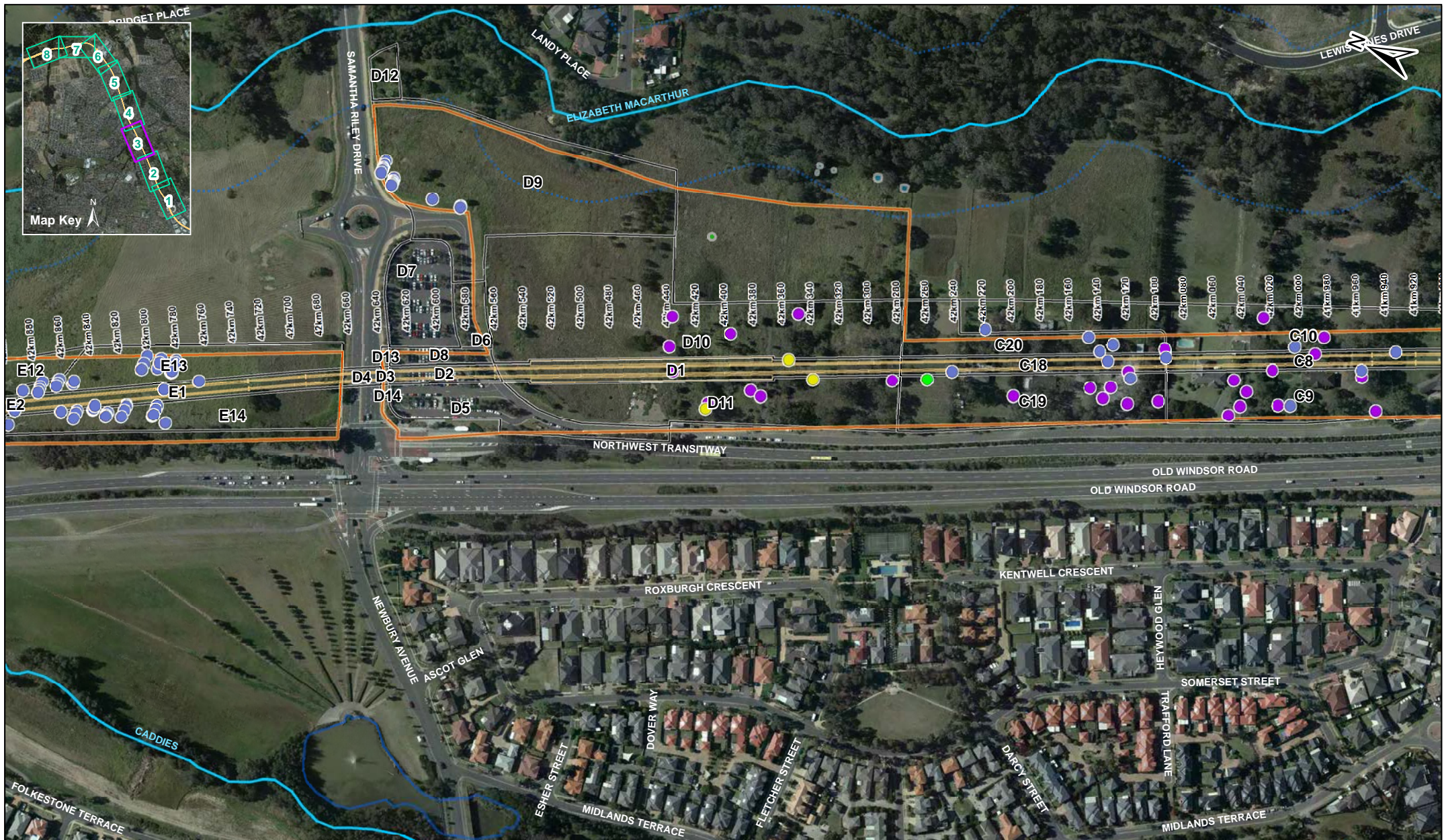


F	18/09/14	EM	Revised Noxious Weeds data		
E	19/08/14	EM	Added noxious weed records	JM	-
D	30/07/14	BH	Revised issue following site works	JM	-
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Noxious and Invasive Weeds		Individual	Infestation
Blackberry	Lantana	Prickly Pear	
Bridal Creeper	Patersons Curse	Thistle	
River / Creek	Concept Alignment: EIS2Sub		
Water body	Construction Boundary EIS1		
Riparian Buffer - Approx	Construction Boundary EIS2		

CLIENT:	Impregilo Salini Joint Venture	DESIGN-DRAWN:	BH	DATE:	SEPT 2014
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 9/10: Balmoral to Memorial				
TITLE:	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Noxious and Invasive Weeds				
SCALE: 1:2,500 @ A3		0 10 20 40 60 80 100 Meters		DRAWING No: FIGURE 2	
REV: F		© WSP Environmental Pty Ltd			



F	18/09/14	EM	Revised Noxious Weeds data		
E	19/09/14	EM	Added noxious weed records	JM	
D	30/07/14	BH	Revised issue following site works	JM	
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Noxious and Invasive Weeds		Individual	Infestation
Blackberry	Lantana	Prickly Pear	
Bridal Creeper	Patersons Curse	Thistle	
River / Creek	Concept Alignment: EIS2Sub		
Water body	Construction Boundary EIS1		
Riparian Buffer - Approx	Construction Boundary EIS2		

CLIENT:	Impregilo Salini Joint Venture
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 11: Kellyville
TITLE:	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Noxious and Invasive Weeds

DESIGN-DRAWN:	BH	DATE:	SEPT 2014
SCALE:	1:2,500 @ A3		
	0 10 20 40 60 80 100		
	Meters		
DRAWING No:	FIGURE 3	REV:	F
© WSP Environmental Pty Ltd			



F	18/09/14	EM	Revised Noxious Weeds data		
E	19/08/14	EM	Added noxious weed records	JM	
D	30/07/14	BH	Revised issue following site works	JM	
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Noxious and Invasive Weeds		Individual	Infestation
Blackberry	Lantana	Prickly Pear	
Bridal Creeper	Patersons Curse	Thistle	
River / Creek	Concept Alignment: EIS2Sub		
Water body	Construction Boundary EIS1		
Riparian Buffer - Approx	Construction Boundary EIS2		


CLIENT:	Impregilo Salini Joint Venture	DESIGN-DRAWN:	BH	DATE:	SEPT 2014
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 12: SR Drv to Windsor Rd	SCALE:	1:2,500 @ A3		
			0 10 20 40 60 80 100		Meters
TITLE:	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Noxious and Invasive Weeds	DRAWING No:	FIGURE 4	REV:	F
© WSP Environmental Pty Ltd					

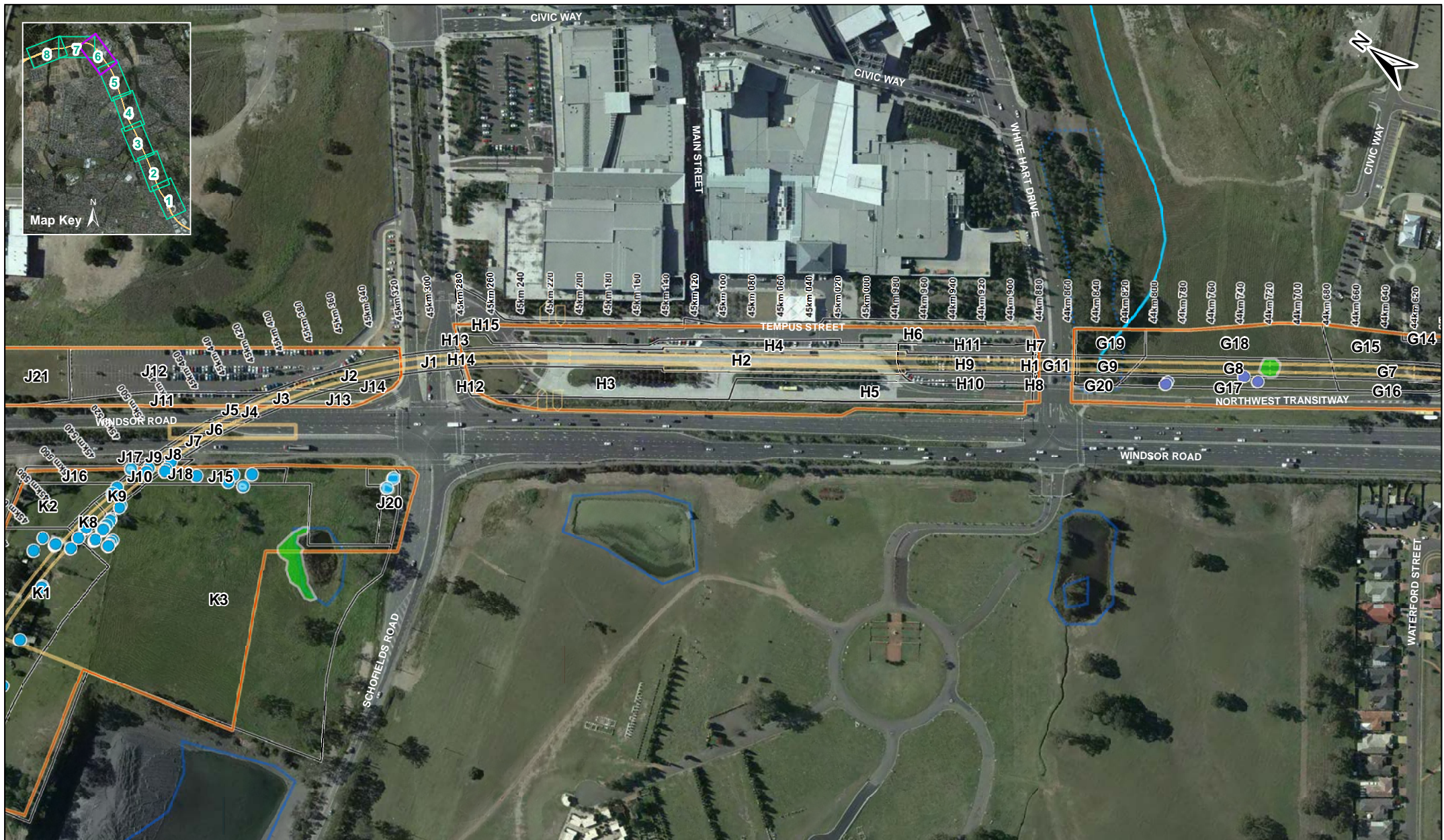


F	18/09/14	EM	Revised Noxious Weeds data		
E	19/08/14	EM	Added noxious weed records	JM	
D	30/07/14	BH	Revised issue following site works	JM	
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Noxious and Invasive Weeds			
● Blackberry	● Lantana	● Prickly Pear	○ Individual
● Bridal Creeper	● Patersons Curse	● Thistle	■ Infestation
— River / Creek	— Concept Alignment: EIS2Sub		
— Water body	— Construction Boundary EIS1		
— Riparian Buffer - Approx	— Construction Boundary EIS2		

CLIENT	Impregilo Salini Joint Venture	DESIGN-DRAWN	BH	DATE	SEPT 2014
PROJECT	North West Rail Link Surface and Viaducts Civil Works Site 13: Old Windsor Rd to WHD		SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100  Meters		
TITLE	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Noxious and Invasive Weeds		DRAWING No:		REV:
			FIGURE 5		F
© WSP Environmental Pty Ltd					

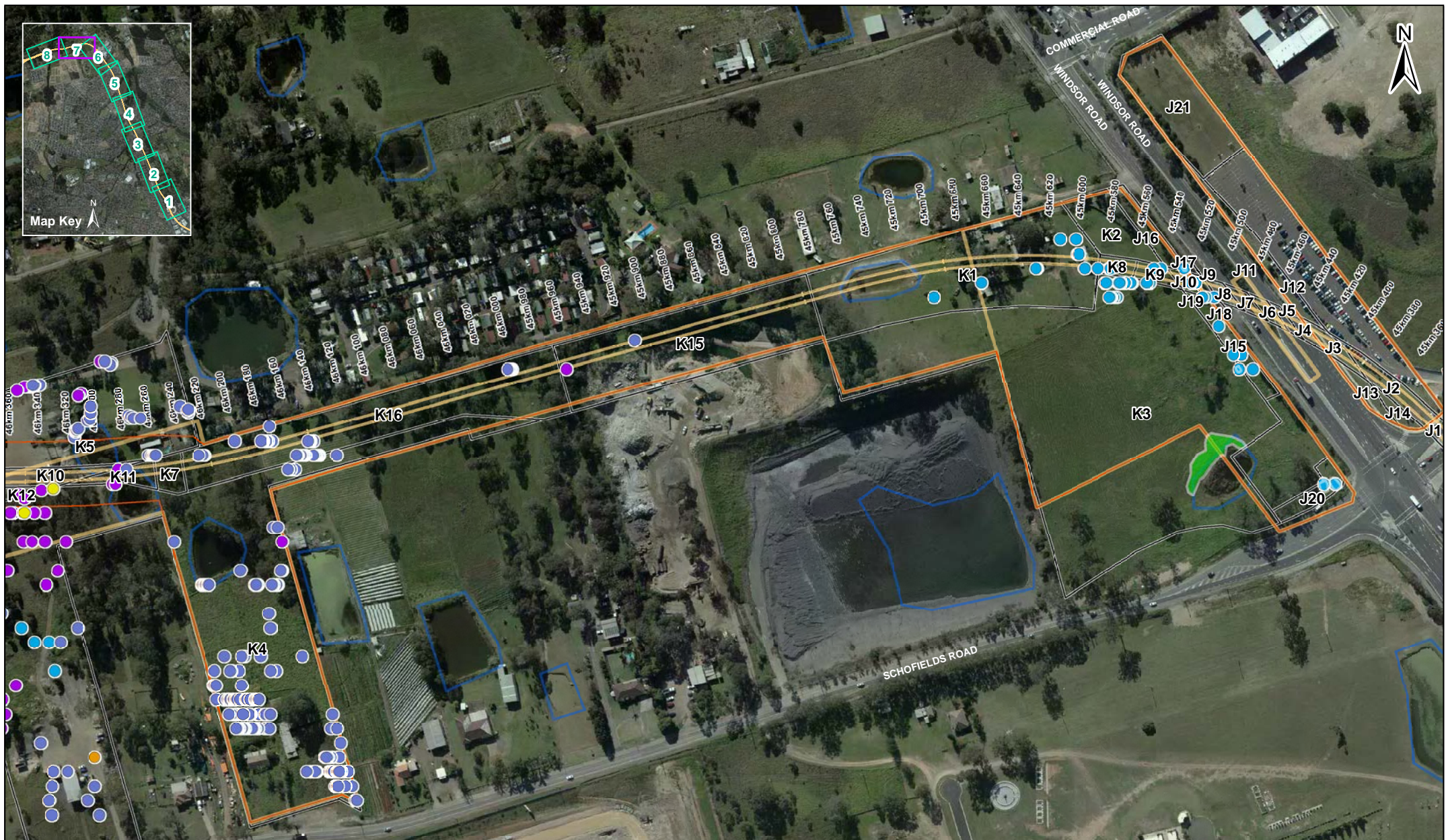


F	18/09/14	EM	Revised Noxious Weeds data		
E	19/08/14	EM	Added noxious weed records	JM	
D	30/07/14	BH	Revised issue following site works	JM	
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Noxious and Invasive Weeds		Individual	Infestation
Blackberry	Lantana	Prickly Pear	
Bridal Creeper	Patersons Curse	Thistle	
River / Creek	Concept Alignment: EIS2Sub		
Water body	Construction Boundary EIS1		
Riparian Buffer - Approx	Construction Boundary EIS2		

CLIENT:	Impregilo Salini Joint Venture	DESIGN-DRAWN:	BH	DATE:	SEPT 2014
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 14: Rouse Hill	SCALE:	1:2,500 @ A3		
TITLE:	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Noxious and Invasive Weeds	DRAWING No:	FIGURE 6	REV:	F
© WSP Environmental Pty Ltd					

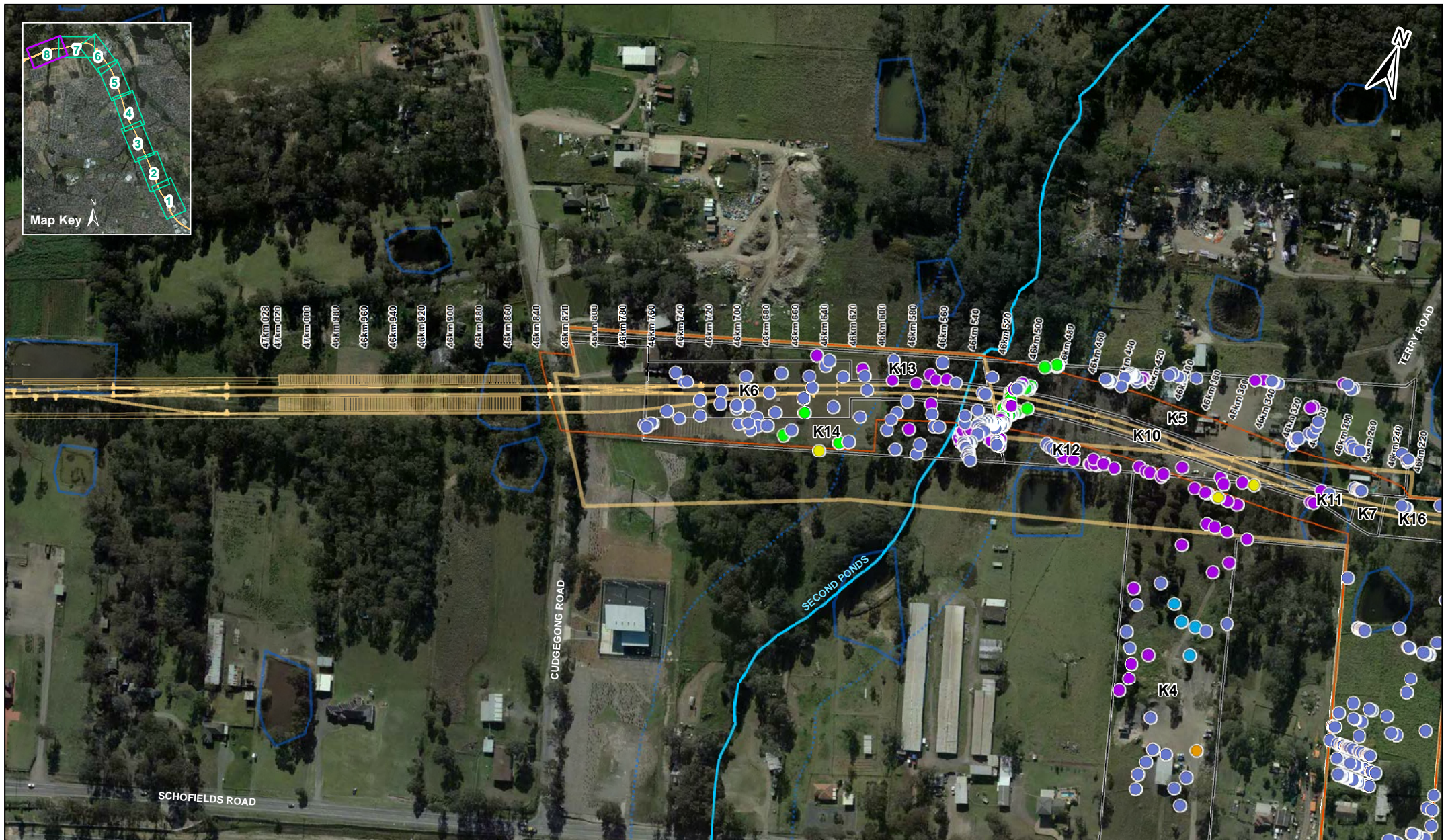


F	18/09/14	EM	Revised Noxious Weeds data		
E	19/08/14	EM	Added noxious weed records	JM	
D	30/07/14	BH	Revised issue following site works	JM	
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS: DRAFT					



Noxious and Invasive Weeds		○ Individual	□ Infestation
● Blackberry	● Lantana	● Prickly Pear	
● Bridal Creeper	● Patersons Curse	● Thistle	
— River / Creek	— Concept Alignment: EIS2Sub		
□ Water body	□ Construction Boundary EIS1		
□ Riparian Buffer - Approx	□ Construction Boundary EIS2		

CLIENT:	Impregilo Salini Joint Venture	DESIGN DRAWN:	BH	DATE:	SEPT 2014
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 15: Windsor Rd Viaduct				
TITLE:	Concept alignment (EIS2Sub) dated 13/10/10. Construction Flora and Fauna Management Plan: Noxious and Invasive Weeds				
	SCALE: 1:2,500 @ A3 0 10 20 40 60 80 100 Meters			DRAWING No:	FIGURE 7
	REV: F			© WSP Environmental Pty Ltd	



F	18/09/14	EM	Revised Noxious Weeds data		
E	19/08/14	EM	Added noxious weed records	JM	
D	30/07/14	BH	Revised issue following site works	JM	
C	04/06/14	BH	Revised issue following TINSW Comments	JM	SF
B	13/05/14	BH	Revised issue following TINSW Comments	JM	SF
A	27/03/14	BH	Draft issue for comment	JM	SF
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					
DRAFT					



Noxious and Invasive Weeds		○ Individual	■ Infestation
● Blackberry	● Lantana	● Prickly Pear	
● Bridal Creeper	● Patersons Curse	● Thistle	
— River / Creek	— Concept Alignment: EIS2Sub		
— Water body	— Construction Boundary EIS1		
— Riparian Buffer - Approx	— Construction Boundary EIS2		

CLIENT:	Impregilo Salini Joint Venture	DESIGN-DRAWN:	BH	DATE:	SEPT 2014
PROJECT:	North West Rail Link Surface and Viaducts Civil Works Site 16: WR Via to Cudgegong Rd	SCALE: 1:2,500 @ A3 <div>01020406080100</div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>			